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W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.

E. P. THOMPSON, Associate Editor Patent Department.

CLARENCE E. STUMP, Business Manager.

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CONTENTS.

ILLUSTRATED ARTICLES:	PAGE.	MISCELLANEOUS:	PAGE
A Monster Telegraph Pole	148	Extensions by the Wisconsin Telephone Company	151
Two Galvanometers	149	Insurance Regulations for Electric Lighting	152
The Freeman Dynamo	150	On the Sensitiveness to Light of Selenium and Sulphur Cells	152
Some New Points in Patent Law	150	A New System of Postal Delivery	152
An Ornamental Burglar Alarm	151	A New Galvanic Cell	153
A New English Arc Lamp	153	On Underground Conduits	153
Philipp Reis	153	Trying the Daft Motor	153
A New Electro-Calorimeter	154	The Course in Electrical Engineering at Cornell University	154
EDITORIAL PARAGRAPHS	147	Telephonic Relays	154
MISCELLANEOUS:		Electric Lighting in the New York Aqueduct	154
Electric Lighting in London	148	Determination of Death by Means of Electricity	155
The Telephone Rate Fight in New England	148	DEPARTMENTS:	
The Relative Merits of Iron and Copper Wire for Telegraph Lines	148	New England Notes	155
The Liability of Telephone Companies	148	The Telegraph	155
Electric Time for Wall Street	149	The Telephone	155
The Pan Electric Telephone Suits	149	The Electric Light	155
Improvement in the Conductivity of Wires	150	Stock Quotations	155
A Notorious Telegraph School	150	Business Notices	155
Some New Points in Patent Law	150	Miscellaneous Notes	155
		Our Illustrated Record of Electrical Patents	156

New Advertisements.

	PAGE.
A More Important Notice	iii
Wanted—A Traveling Carbon Salesman	v
For Sale—100 Electric Motors	v
For Sale—Incandescent Electric Light Systems	v
John A. Cabot—Multiplex Mechanical Telephone	v
Charles B. Bodie—The B. T. K. Storage System	vii
REARRANGED ADVERTISEMENTS.	
Chas. A. Schieren & Co.—Leather Belting	i
The Leclanché Battery Co.—The "Gonda" Battery	ii
Gill & Segerdahl Company, Succeeded by J. F. Wollensak	iv
Western Electric Co., Electric Lighting Apparatus	viii

Vol. VI. NEW YORK, OCTOBER 10, 1885. No. 15.

THE New York Electrical Subway Commission, after hearing a number of experts, will take more evidence and opinion until the 15th. After that time ——.

THE City Councils of Philadelphia have just granted the Western Union Telegraph Company permission to tear up the streets for the purpose of putting their wires underground. The company cannot possibly have its wires underground by Jan. 1, as the law provides.

BY reference to another column, it will be seen that London is, of all the large English cities, the slowest to advance in electric lighting. Aside from private lighting, no great attempts have been made to illuminate the streets by electricity, and one of our English contemporaries bewails this sad lack of appreciation for the beautiful light. It points with admiration to our American cities, and asks how long the blunders of past legislation will prevent the adoption of the best system for London.

THE number of combinations possible with existing chemicals makes the appearance of new forms of voltaic cells of almost daily occurrence. Comparatively few, however, are found which are an improvement over familiar forms. Our article, by Professor Dolbear, however, describes a battery which possesses valuable properties, not the least among which is its cheapness. The electromotive force obtained with one form of the cell, 2.3 volts, is something extraordinary, and its constancy also is remarkable.

THE study of the selenium cell has brought out the curious fact that selenium is not necessary for the construction of a cell which shall be sensitive to light. The similarity which selenium bears to sulphur led Mr. Shelford Bidwellto experiment with the latter, and he has succeeded in obtaining cells which, though not equal to the selenium, give very encouraging results. The availability of sulphur having been demonstrated, the "light-cell" ought now to become the subject of more universal investigation, from which it has heretofore been debarred by the difficulty and expense in procuring selenium. Not the least interesting fact brought out in connection with "light-cells" is, that some forms among them act as storage cells, which was demonstrated by Professor Sylvanus P. Thompson.

A PRELIMINARY decision has been rendered in the Indiana telephone rate suits. It is that of Judge Parrett, of the Vanderburg and Posey Circuit Court, in the telephone litigation now pending in Evansville. The Judge announced that he was satisfied as to the constitutionality of the law passed by the last Indiana Legislature, limiting telephone charges to $3 per month. He added that the word "telephone" in the law included all the various appliances in the telephone business necessary to its successful operation, and that the defendant, though a foreign corporation, was subject to the laws of the State. In reply to defendant's pleas that the royalty paid to the Bell Company would not admit of doing business at $3 per month, the Judge said if such was the case they should quit business. This is first blood for the subscribers, but the fight is not over yet.

THE bust erected to Philipp Reis is a deserved honor to the memory of a man whose life was devoted to the disinterested pursuit of science. His work, though unproductive of practical results in his day, must, nevertheless, be considered brilliant in the highest degree. His studies, founded in the beginning upon a thorough examination of the construction and functions of the human ear, soon led him to adopt various changes toward perfecting his instruments; and the difference between his first attempts and final results give ample evidence of his powers of perception and reflection, traits which are strongly indicated by the broad, high forehead pictured in the illustration on another page. Germany has produced many great men, and among these Reis undoubtedly deserves an eminent place. All scientists must unite in doing homage to a genius who labored at a problem in the most unselfish manner for the advancement of science; and such a man was Philipp Reis.

IF any doubts still exist regarding the relative efficiency of copper over iron wires for telegraph and telephone purposes, they must be dispelled by the results of tests instituted by the indefatigable Mr. Preece. He shows that while copper can be used without detriment to the economy in cost of the line, its superior properties make it far preferable to iron. He has shown that on a line 278 miles in length, working simplex, the speed can be increased from 345 to 414 words per minute, and with duplex from 237 to 270 words. In addition to this increased working capacity, Mr. Preece points out that by using copper wire, intermediate repeaters may in many cases be dispensed with on long lines where they are now necessary. Perhaps the most interesting point in connection with the experiments is, that they prove that the superiority of copper is not simply due to its smaller electro-static capacity and resistance, but that it is more susceptible to rapid changes of electric currents than iron. As Mr. Preece points out, the magnetization of the iron acts as a kind of drag on the currents, and this explains the frequently observed fact that telephones work better on copper than on iron wires. It confirms, too, the general opinion, if further confirmation is indeed necessary, that copper is undoubtedly superior to iron in all respects, and we confidently believe that the uses of iron wires are lessened by the greater favor to be shown to copper.

WE publish to-day further details and information in regard to the suits brought by the United States against the American Bell Company, at the instigation of the National Improved Telephone Company. The various points raised are very important, and, reviewing the case as presented so far, we see no reason to change the opinion expressed on this page last week. A most unusual proceeding has been resorted to under circumstances that cannot but bring suspicion on the high Government officials concerned, and the vindication, if any is to be offered of their conduct, must be fuller than any excuse that has yet been made public. We note that in a letter to the newspapers Mr. E. N. Dickerson says very bluntly that in his opinion there is, after all, no authority by which the Attorney-General of the United States can institute proceedings to annul letters patent, either because the patentee is not the first inventor or for any other reason. He supports his opinion by some very long and ably stated cases and argument. We quote a part of it. The point made is that even if Mr. Bell obtained his patent unfairly, the Attorney-General cannot interfere to deprive him of it, in this way. This, perhaps, is hardly enough to satisfy the public, which will certainly not disturb Mr. Bell and his representatives in their patent if it be justly theirs, but which would probably stand at nothing if by wiping out a foundationless patent it could get telephone service cheaply. The American Bell Company, we hear, treats the Wilbur affidavit with contempt.

IN another column we give some of the new rules and regulations just adopted by the New England Insurance Exchange for the government of companies and individuals engaged in the wiring business. Since former issues of similar rules, new conditions have appeared, made necessary by the frequency with which incandescent lamps have been placed on circuits employing currents of high potential, and also by the increase of the E. M. F. employed in incandescent systems proper. The confidence which has been inspired in the public mind by the performance of the more successful multiple arc systems has gradually led up to a practice of wiring expensive buildings during construction, and, of course, concealing the work permanently almost as soon as placed. Under these circumstances, it is not surprising that an occasional job, when performed by bell-hangers, gas-lighting firms, or other parties entirely inexperienced in the calculation of size of wire necessary to secure a safe and uniform distribution, has given trouble and failed of approval by competent insurance inspectors. These concealed dangers, or possibilities of their arising, have perhaps been the chief incentive to the arrangement of these revised requirements. The officials of the New England Exchange, in their control of all the insurance interests of the Eastern States, outside of Boston and the factory plants embraced in the special field of the Manufacturers' Mutual Company, have under consideration a plan for systematizing their work by virtually committing the general oversight of their electrical inspection to the care of one competent person, to whom all local inspectors shall be responsible for the enforcement of rules adopted. They have also inaugurated an important improvement in their inspector's certificate, which defines the number of incandescent lamps of given candle-powers which may be safely attached to any system of wiring, and, in case of large installations, to the various departments into which the system may be divided; the aim being to prevent the overloading of any portion of the circuit by forbidding changes unless specially authorized. We trust that the important points embodied in this code, some of which are entirely new, will receive the careful attention of electric light people and insurance boards generally.

CORNELL is the first among our universities to organize a course of electrical engineering, and in so doing sets a good example to other institutions. Prof. Thurston, who has been intrusted with the directorship of Sibley College, has wisely arranged a course in which students may prepare themselves for a branch which even now is of great importance, and which will certainly rise to a greater importance in the future. An examination of the course will show that while designed from an electrical standpoint, it comprises largely the course of mechanical engineering. This is as it should be. No electrical engineer can be successful in his profession without a thorough knowledge of the properties of materials and their application, the design and construction of machines, the various motors, and the numerous other branches with which the mechanical engineer is conversant. As a beginning, the course laid out is to be commended, but we would suggest certain improvements which we think would greatly add to its value. An analysis of the course shows that during the first year no time is devoted to electricity as such. In the second year only three hours per week are given to the study of electricity and magnetism. The junior year again contains nothing of special reference to electricity, and it is only in the fourth year that it is taken up with any degree of fullness. Without recommending a change in the first year's course, we would suggest that a more even distribution be made, and increased time be devoted to electricity during the subsequent years. It will be seen that in the sophomore year no more time is given to electricity and magnetism than to acoustics and optics. A part of the junior year ought to be devoted to a continuance of the study begun in the sophomore year, aside from the work relating to the subject, which may be done in the physical laboratory. The plan for the senior year seems well adapted to convey a good knowledge of some of the principal branches in electrical engineering,—the dynamo and its applications. We think that, in addition, a series of lectures on the various applications of electricity would greatly enhance the value of the course, and open before the student numerous channels in which he can devote his energies. Besides, the electrical engineer of to-day is called upon to engage in works of such varied character that without a good knowledge of the capability and applications of electricity he will be at a disadvantage. It cannot be expected that in inaugurating such a course it can be developed immediately to its full extent, but we have no doubt that with the lapse of time improvements and additions will be made which will place the study of electrical engineering on an equal footing with that of mechanical and civil engineering.

Electric Lighting in London.

Though England has been said to be invariably behind the principal Continental countries and America in the adoption of that which is startlingly new, however useful, it can scarcely be asserted with truth, remarks the London *Electrical Review*, that London, and more especially the City of London, has been so conservative of ancient ideas and customs as to allow even provincial towns to precede her in modes of obvious improvement. Rapid strides have been made of late years in the combination of beauty, in contradistinction to mere prettiness, with strength and stability in metropolitan architecture; for, notwithstanding that there have been several glaring failures in this respect, the fact remains that London of to-day is a vast improvement from an architectural point of view—supposing, of course, that view not to be of the purely fanciful order—upon the London of a hundred, or even fifty years ago. Seeing this fact, one would have expected that the very best means of illuminating the modern beauties of the city and its vast outgrowth would have been adopted as soon as it was discovered that there was a better than that in vogue. Yet while other towns are at least making attempts in this direction, and private prescience is manifesting itself in instances increasing in number every day, we see only the most insignificant efforts made in the Metropolis of the World to have its streets lit by the one effective means of illuminating during the dark hours of the night and those features of interest which deservedly command so much attention while the light of day shines upon them. There is a social side to this question, for in many American towns the brilliant light has been found of rare virtue in suppressing evil doing of many kinds; but it is not for us to deal largely with that aspect of the matter in these columns. Londoners in their corporate capacity are showing a sad lack of appreciation for the beautiful light placed at their disposal, and we can only ask, in conclusion, how long the blunders of the past are to prevent its adoption.

The Telephone Rate Fight in New England.

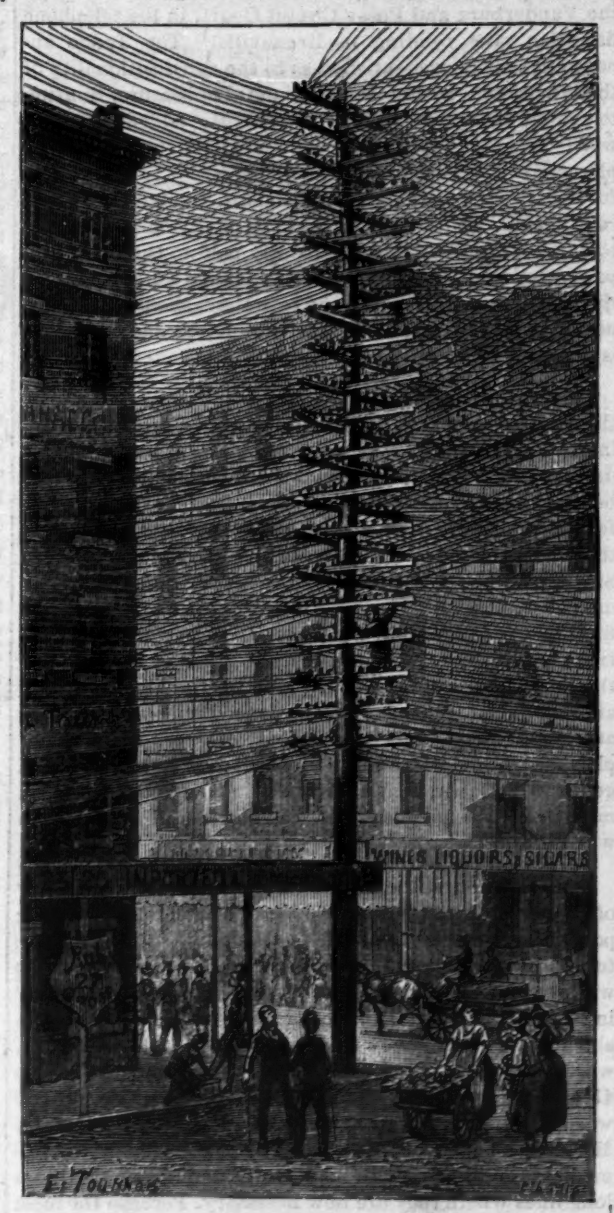
The struggle for and against telephone rates in New England goes on with varying success. The authorities of the New England Company claim to have experienced less trouble than they anticipated, while the fighting subscribers say they are winning all along the line. A dispatch of Oct. 2 from Lowell says: "Thirty-one telephone instruments were removed here yesterday and today, in anticipation of the increase in rates which goes into effect on the 15th inst., and orders have been received at the central office for the removal of thirty others before the 15th. Several petitions are in circulation binding subscribers to have their instruments taken out, and not to have them put in again until the old rates are restored. One petition has ninety-nine signatures." Another dispatch of Oct. 1 from Haverhill says that telephones have been taken out there. The newspapers, of course, take a hand. The Manchester *Mirror*, which has been fighting the advance very fiercely, thus indicates some points of the situation in that city:

"The telephone is a wonderful invention, but it is scarcely more marvelous than the system used by its managers in arranging the tariff in this city. When it was first established here it was confined to the compact part of the city, and when parties in the suburbs and adjoining towns asked for it they were told they could have it by building the line themselves. To this several of them acceded, and it was accordingly extended to West Manchester, and thence to Shirley Hill, in Goffstown; Mr. Huntress, the nursery man, Governor Cheney, Colonel Shirley, and perhaps some others paying the cost of construction, and, having done this, they have enjoyed its use upon the same terms as those in the city who paid nothing for wire or poles. But now comes the readjuster of rates with a purpose to make the stock, two-thirds of which is pure water, remunerative, and decrees that Mr. Huntress and Colonel Shirley and the others who built the line shall pay a large per cent. more than those who built none. Thus Mr. Huntress, who contributed $40 for wire and poles, is assessed $5 a month, as against $4.17 for parties on this side of the river; and Colonel Shirley, who paid much more than $40, is invited to remunerate the company for what he has given them to the tune of $5.94 a month. Whether this extra charge to the men who helped to build the line is in the nature of a penalty for having had anything to do with the affair, we do not know, but the facts are as stated, and they help to provoke people and add force to the rebellion against the proposed advance in rates."

The Springfield *Union* suggests that "there will probably be a different arrangement in telephone tariffs in New England at some future time, one by which users of telephones will pay according to the use they make of them. Some subscribers use the telephones almost constantly during business hours, while others use theirs very seldom, sometimes a whole day passing without giving or receiving a call. There is an element of unfairness in that, and a more equitable plan will come in time. Such a plan is already in use at Buffalo, N. Y. In that place a telephone is put in for a certain sum, $5, if we are correctly informed. The subscriber then takes a certain amount of tickets, which are good during one year and not after the year expires. Each month a bill is rendered of the number of calls from each telephone, and the tickets are collected for those calls. In that way a man who uses the telephone only occasionally will get his service for about $12 per year, while a man who uses his telephone a great deal will pay accordingly. By that arrangement each subscriber pays for his own service and not for anybody else's, and the fairness of that to all concerned is obvious."

Monster Telegraph Poles in New York City.

When some members of the staff of one of our esteemed foreign contemporaries came to this country to attend the Philadelphia Electrical Exhibition they were struck by many novel sights, not a few of which they illustrated on their return home. In commenting on the progress of telegraphy with us they draw attention to the (to them) extraordinary sight presented by our telegraph poles. Thus they illustrate a telegraph pole which is claimed to be situated in Fulton street of this city, and upon which 300 wires are claimed to be strung, going in all directions. This pole, however, while existing, is but an aggravated case, and we doubt if a similar



A Monster Telegraph Pole, New York.

one could be found anywhere else in America. In actuality, the wires do not present nearly so formidable an appearance as the illustration would convey.

The Relative Merits of Iron and Copper Wire for Telegraph Lines*

BY W. H. PREECE, F. R. S.

Copper is gradually replacing iron for aërial telegraphs, owing to its greater durability in the atmostphere; but its greater cost has led to the use of smaller-sized wires. This can be done without detriment to the economy of the line, for the resistance of copper, as compared with iron, varies very nearly inversely as its price per ton, and hence the cost per mile remains about the same. Hitherto only short lengths have been erected in smoky towns and through districts where chemical industries filled the air with gases destructive to iron wires; but the Post Office Telegraph Department has recently erected a No. 14 copper wire, .080 inch in diameter, weighing 100 pounds per mile, all the way from London to Newcastle, 278.08 miles in length, and it became desirable to measure very accurately its electrical elements, so as to see if it possessed, as was anticipated, any marked advantage as a telegraph line over the galvanized iron wires hitherto used.

There were two series of experiments made. In the *first* series the relative electrical condition of the two kinds of wires was determined, and in the *second* series their relative rates of working.

* Extract from a paper read before the British Association at the meeting at Aberdeen.

The first series was divided into two parts, the one consisting of tests made from Bishop Auckland to Teams, near Newcastle, a distance of 30.285 miles on the north side, and to Pierce Bridge, a distance of 9.172 miles on the south side, and the other consisting of tests of a section of line between Pierce Bridge and Baldersby Cross-Roads, 26.7 miles in length. The poles carried 10 wires. The tests were made in dry and favorable weather by Messrs. Kempe & Eden.

On the first of these lines the calculated electrostatic capacity of the copper wire was 8.4 per cent. less than that of the iron wire. This result agreed pretty closely with the mean value of the differences of capacity obtained by actual measurements on these sections, viz., 9.1 per cent.

For the Bishop Auckland-Pierce Bridge section the calculated capacity of the copper was 8.6 per cent. less than that of the iron, while the actual value was found to be 9.7 per cent. The differences between the calculated and the experimental values are probably due to the influence of trees, buildings, etc., which cannot be allowed for theoretically. These measurements were made when the other wires on the poles were left insulated. The effect of having all the other wires to earth when the capacity of any one wire was measured, was very marked. Thus, on one wire the capacity was increased from .352 to .451 microfarad, or 22 per cent. It would therefore appear that the mean capacity per mile of a single iron wire of .171 in. in diameter, placed about 20 ft. above the ground, is .0131 microfarad; while an iron wire of the same size, suspended at the same height, but surrounded by other wires forming telegraphic circuits, would have a mean capacity of .0169 per mile. The capacity of copper wire of .080 in. diameter under similar conditions would be about .0120 and .0142 microfarad per mile respectively.

As regards the induction between wire and wire tests, the effects obtained were very slight, though their actual value was determined with comparative accuracy.

The second series of experiments were conducted between London and Newcastle, and were designed, as stated above, to test the working efficiency of the copper wire as compared with iron wires. They were conducted by Messrs. Chapman and Eden. The results showed that copper has a very decided superiority over iron, the speeds being as follows:

	Copper.	Iron.
Simplex working	414	345 words per minute.
Duplex "	270	237 " "

It is anticipated that the superiority of copper over iron, indicated by these experiments, will have a beneficial and economical influence on our telegraph system, and that its extended use will enable us not only to work better, but to dispense with intermediate repeaters in many cases where, on long lines, they are now necessary.

The most interesting point, however, in connection with these experiments is that they prove that the superiority of copper is not simply due to its smaller electrostatic capacity and resistance, but that it is more susceptible to rapid changes of electric current than iron; for when the resistance and capacity of the copper and iron wires were equalized by the insertion of resistance coils and condensers, the speed on the former was not thereby diminished. Possibly the magnetic susceptibility of the iron is the cause of this. The magnetization of the iron acts as a kind of drag on the currents. It is well known that telephones always work better on copper than on iron wires, doubtless for the same reason.

These experiments also show the high speed of working that is now attained by the Post Office authorities with the Wheatstone automatic apparatus. The following table gives an interesting *résumé* of the different stages of the progress made and its rate of growth:

1877	80 words per minute.
1878	100 " " "
1879	130 " " "
1880	170 " " "
1881	190 " " "
1882	200 " " "
1883	250 " " "
1884	350 " " "
1885	420 " " "

The Liability of Telephone Companies.

A man who was injured by tripping over fallen telephone wires in the street at night, sued the city and telephone company for damages. On the trial of the case—Nichols vs. City of Minneapolis—it appeared that on January 31 there was a fire, at which the firemen, in throwing water on the building, threw it on the cross-bars supporting the wires to such an extent that the ice accumulated so that they were broken from the poles, and dragged down into the street all of the wires, forty of them. The next day this section of wire was cut and new wires put up, but the old wires were left in the street. The plaintiff recovered judgment against the city and the company, and both these appealed to the Supreme Court of Minnesota, where the judgment was affirmed. Judge Mitchell, in the opinion, said: "1. The neglect of the city to remove the wires for an entire week makes it clearly liable. 2. The license to the company to erect poles and run wires had its burdens. It carried with it an implied obligation to erect and maintain these wires in a safe condition, so that they should not become nuisances or endanger the safety of the traveling public; and if it suffers them to fall and remain in the street, it is liable to any one injured thereby."

Two Galvanometers.

Our illustrations represent two instruments recently constructed by Messrs. Hartman and Braun, and imported by Messrs. Queen & Co., of Philadelphia. The instrument shown in Fig. 1, which is designed to be used for a large range of work, is mounted upon a tripod supporting a revolving table upon which the other parts of the instruments are fixed. The coils are mounted upon a horizontal graduated rod, and can be moved by means of a rack and pinion. Several coils are provided, which can be rapidly changed so as to suit different work, and their compound winding also permits of great delicacy being attained. Siemens' bell-magnet is used, which is dampened by a surrounding copper cylinder, made in two parts, so as to allow of access to the suspended magnet within. The needle can be made astatic by means of the magnet above it, but Prof. Baum has suggested another method, which consists in surrounding the entire instrument by a massive ring of soft Swedish iron, which can be moved vertically. This method of decreasing the influence of the earth's magnetism is superior to that in which a magnet is used, and increases the sensitiveness of the instrument sixfold.

Fig. 2 shows a galvanometer designed for lecture purposes and demonstration before large audiences. In the centre of a circular metal plate fitted with leveling screws is a copper damper for the bell magnet, which is suspended from a fibre, and on the damper are mounted two

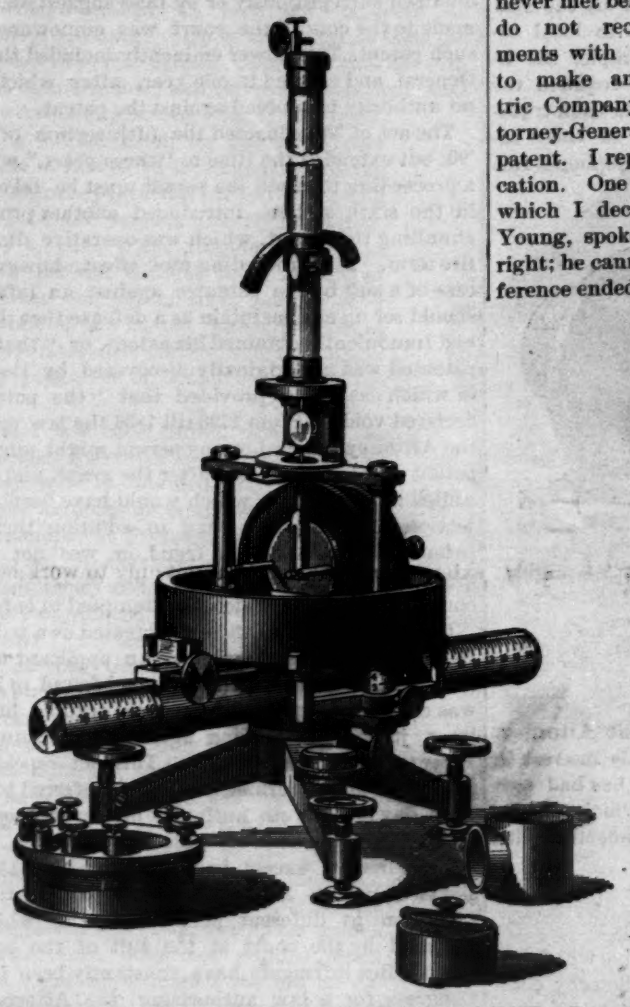


FIG. 1.—GALVANOMETER FOR A WIDE RANGE OF WORK.

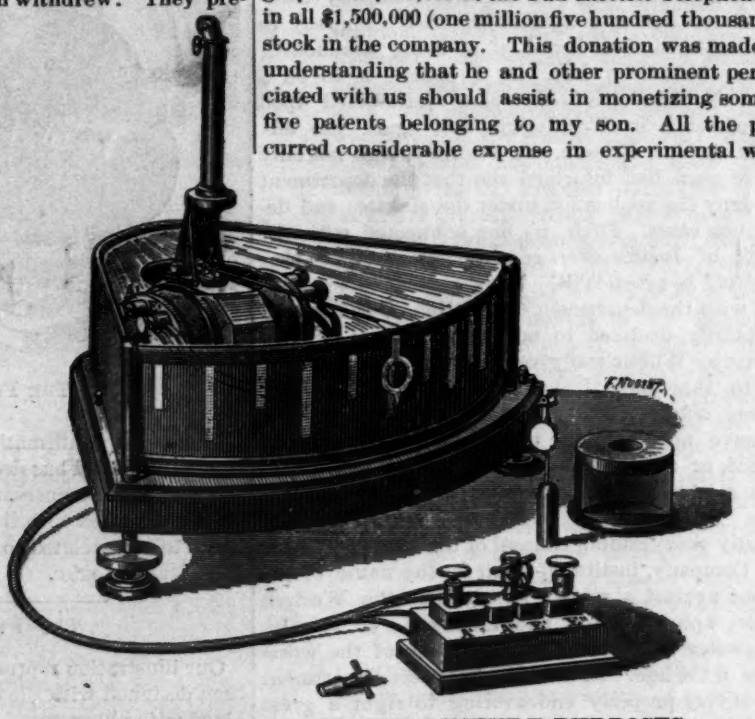


FIG. 2.—GALVANOMETER FOR LECTURE PURPOSES.

small columns which carry the suspension tube. On one side of the suspended needle is a coil of thick wire, on the other side a coil of thin wire, the connections to which are carried through the base plate. Concentric with the axis of the needle is a large upright metal ring, on which the divisions are marked in large figures. To the suspension of the needle is fixed a straw carrying at its end a piece of white paper which moves over the upright scale.

The instrument was designed by Prof. v. Beetz, of Munich.

Electric Time for Wall Street.

The Mackay-Bennett Commercial Cable Company will erect, during the course of this month, a handsome electric clock in front of their office on the corner of Wall and Broad streets. The post which is to support the clock is already up, and is made of bronzed iron, 16 feet in height. The movement of the clock, including all the internal works and machinery, is being constructed by the Standard Electric Clock Company, and the exterior workmanship is being done by the New Haven Clock Company, of No. 16 Park Place.

The clock is in the form of a large globe four feet in diameter, on which the outlines of the continents are painted in blue on a background of gold, the names of countries and the chief cities being also given. There are to be three faces or dials, each of which will be illuminated by an electric light. Each dial is 24 inches in circumference. Above each dial will be painted the words "The Commercial." Then the figures on the faces will be represented by the words "Cable Company," the letters of which are the same in number as the figures of an ordinary clock. These letters are of raised iron, and are twisted to represent cable. Underneath each dial will be painted the words "Mackay-Bennett Cables." There will be four hands on each dial, two of which will show English time, while the other two will tell New York time, thus affording easy means of comparison. The globe will be surmounted by a ball, on which will be perched, facing the statue of Washington, a big gilt eagle with outspread wings.

The clock, when completed, will be a great addition to "the Street," both in point of use and as a very handsome specimen of clock architecture.

The Pan Electric Telephone Suits.

The suits brought by the United States against the Bell patent, and the connection of Attorney-General Garland with the opposition Pan Electric Company, have been the engrossing topic of conversation among electricians during the week. The explanation now forthcoming from Mr. Garland is as follows:

"So far as my official connection with this suit is concerned, the story is a short one, and was really all told in my dispatch published in the newspapers. I did not authorize the bringing of the suit, nor did I know that such a suit had been instituted until I received the dispatch asking if I had authorized it. I will say this: One hot day in the summer—probably about the end of July or the beginning of August—General Casey Young, of Memphis, came in here, accompanied by Colonel Gantt, a lawyer of Memphis; Mr. Van Benthuysen, whom I had never met before, and another gentleman whose name I do not recall. They brought a number of documents with them, and explained that they had come to make an application in behalf of the Pan Electric Company, to have a suit brought by me as Attorney-General of the United States to annul the Bell patent. I replied that I could not consider such an application. One of them then asked me several questions, which I declined to answer, when Col. Gantt, or Gen. Young, spoke out and said: "The Attorney-General is right; he cannot answer those questions." There the conference ended and the gentlemen withdrew. They presented no written application, or other papers to me, neither did they urge, as perhaps they might have done, that simply because I was an individual stockholder in the Pan Electric Company, I would not be justified as Attorney-General in refusing to consider an application from other stockholders to have the Government bring a suit agains the Bell Company and denying them a proper and legal remedy. That phase of the subject was not raised or discussed, and the matter was not brought to my attention again by any person until last week. Neither did I ever mention it to the Solicitor-General, who authorized the bringing of the suit in my absence, and he will tell you so. I have been a stockholder in the Pan Electric Company since it was organized, some two years ago. I acquired my stock when I was a private citizen, at least so far as my connection, present or prospective, with the Department of Justice was concerned."

Solicitor-General Goode says: "As soon as I could see the Attorney-General to-day I mentioned the public criticism on account of the action of the department in authorizing the bringing of the suit to set aside the Bell patents, and told him that I desired to shoulder the entire responsibility of that action and to be held accountable if any mistake had been made, for I had issued the order after a careful investigation of the subject, and wholly without regard to the question as to who were the parties in interest. I desire to repeat that statement to you in the most comprehensive and emphatic manner possible, and to say further that Mr. Garland never mentioned the subject of the telephone litigation to me, and that I did not know when I acted in the case that he had ever been asked to begin such a suit. The facts are as follows: Mr. Garland left Washington on the evening of Aug. 27, and I became Acting Attorney-General under the law. On Aug. 31, four days after Mr. Garland's departure, District Attorney McCorry, of the Western District of Tennessee, addressed me a letter from Jackson, Tenn. In that letter he set forth the grounds for his belief that the Bell patent was fradulently obtained, and applied for authority to begin proceedings to annul it. I received Mr. McCorry's letter on the morning of Sept. 2. On the same morning Senator Harris and ex-Congressman Casey Young were in my office to discuss the matter. We talked it over, and I told them that I would investigate and consider it, and give my decision the next morning. I went over the case with great care, and the next morning when Gen. Young called for my answer I informed him that I had already authorized the District Attorney to begin the suit. That is all there is of it. If any mistake has been made or wrong done, I alone am responsible. I simply examined the matter to see whether the proposed proceeding would be regular, and I not only became satisfied on that score, but was convinced that it was the only manner in which the validity of the Bell patents could be tested."

The subjoined appears in the New York *Tribune*:

My attention having been called to your criticism of Mr. Garland's conduct in bringing suit in the name of the United States for the Pan Electric Company against the Bell company, I wish, in justification of a faithful public servant, to give you a complete history of the proceedings, and believe that you will at least see the matter in a new light, and give the salient points of my defense to your readers.

I have been for several years attorney for my son, J. Harris Rogers, the inventor of "The National Secret Telephone" and of the "Pan Electric Telephone" systems, and had been for a long time anxious to have a suit brought by the Government against the Bell Company to cancel their patent, which claimed "the art of telephony," known to have been invented by Philipp Reis, of Germany. Three years ago I donated to Mr. Garland $500,000 stock in the original Pan Electric Company, which carries with it $500,000 in the Pan Electric Telegraph and $500,000 in the Pan Electric Telephone, making in all $1,500,000 (one million five hundred thousand dollars) stock in the company. This donation was made with the understanding that he and other prominent persons associated with us should assist in monetizing some twenty-five patents belonging to my son. All the parties incurred considerable expense in experimental work, renting of telegraphic lines between New York and Washington, manufacturing, etc., but were soon reimbursed about $10 for one from sales of State rights (still retaining all their stock). Mr. Garland and Senator Harris had both given their written opinions that our patents did not infringe the Bell patent—a copy of which I send herewith.

Soon after Mr. Garland's promotion to the office of Attorney-General, I applied to him to move against the Bell Company, but he declined doing so. I then by letter requested Senator Harris, General Joseph E. Johnston, the Hon. Casey Young and other members of the company to urge him further, but he still declined, Mr. Young reporting to me by letter that the Attorney-General felt a delicacy in the matter on account of his ownership of stock in the company. I had always appreciated his high sense of honor, but could not see how his *private feelings of delicacy* should deprive me and my associates of our right, as citizens, if we had a right to try the validity of our patent in the manner proposed. Furthermore, Mr. Garland being indebted to me, not only for his $1,500,000 stock, but for my efforts in getting him appointed Attorney-General, I began to feel that he was not inclined to reciprocate the favors I had done him; but to relieve him in a measure of the delicacy referred to, I prevailed (through my agents) on "The National Improved Telephone Company"—a small corporation founded on several of my son's earlier patents—to press once more upon Mr. Garland my favorite plan for canceling the Bell patents, and he, having no stock in this company, consented; but said (so the Hon. Casey Young reported to me and my son) that he would leave the matter with Mr. Goode, Assistant Attorney-General, and so he did; and accord-

ingly the suit was commenced by the United States in behalf of a company in which Mr. Garland owned no stock, and in behalf of citizens of the United States who had made out a *prima facie* case against the Bell Company to the satisfaction of Mr. Goode. How Mr. Garland or Mr. Goode could have acted otherwise, as faithful public servants, passes my comprehension.

Respectfully, J. W. ROGERS.

Attorney for J. Harris Rogers, inventor of the "Pan Electric" and "National Telephone" systems.

To this Mr. Van Benthuysen makes the subjoined reply:

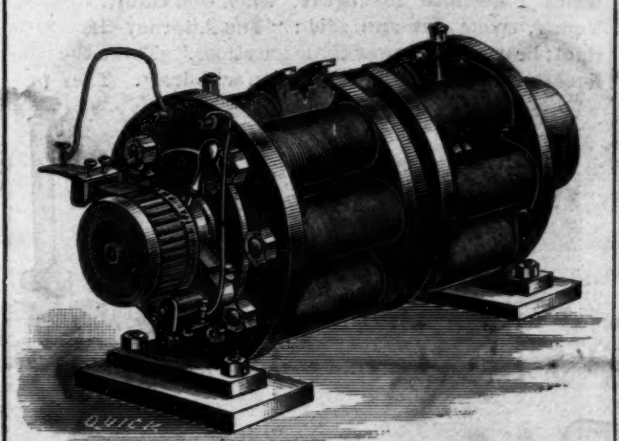
"I respectfully ask the privilege of replying through the columns of your paper to a letter signed by one J. W. Rogers and published in the *Tribune* of the 30th; also to answer the interrogatories propounded to me in the same paper. First, I do not know J. W. Rogers except by reputation, which I am informed is very bad, and when he "prevailed through his agent on the National Improved Telephone Company," a small corporation founded on several of his son's earlier patents, to press once more upon Mr. Garland his (Rogers') favorite plan, he tells a deliberate falsehood. No agent of any one called upon the National Improved Telephone Company or any one connected with it for any such purpose, nor was said company ever founded upon any such patents, and I do not believe that Gen. Garland or any of the gentlemen mentioned by him have business or social relations with said J. W. Rogers. In answer to the interrogatories, I beg leave to say: First, I did not receive any reply to my letter of July 12, except that it had been referred to the Department of the Interior and thence to the Commissioner of Patents. Finding I was laboring under a wrong impression about the law, I asked permission to withdraw the letter, and it was granted. Second, I did have an interview with Gen. Garland, accompanied by A. Von Briesen, Esq., of New York, and one or two others, at which Gen. Garland peremptorily declined to act in the premises. Third, I know nothing of any legal proceedings instituted by the Pan Electric Company in Memphis against the Bell Company, and their abandonment. I know the Pan Electric Company instituted a suit for damages against the Bell Company in Memphis, and have never heard of it being abandoned, and do not believe it has, as I believe it to be a good suit. Fourth, the only plan determined upon at any conference in Washington was upon the advice of Mr. A. Von Brieson, my attorney, who not only advised the plan, but informed me that the department could not deny the application under the statutes and decisions in such cases. Fifth, no one connected with the Department of Justice ever gave me any assurance that the plan would be practicable. I never spoke to any one connected with the department except Gen. Garland, and he peremptorily declined to act in any manner. Sixth, The affidavit by Wilbur was given on the 30th of July. Previous to that date I had never known Wilbur. My attorney obtained the affidavit; therefore, if Gen. Garland gave any opinion to the Pan Electric on July 5, 1884, or a year before the affidavit was given, there was no connection between the advice and affidavit. Mr. Brewster, the preceding Attorney-General, and for many years leading counsel of the Western Union Telegraph Company, instituted a suit in the name of the Government against a rubber patent that the Western Union Telegraph Company had infringed. In this instance Brewster aided what had been one of the worst monopolies of the age. In the recent case the Department of Justice is very properly endeavoring to right a great wrong and annul what the Government claims to be a fraud and outrageous imposition upon the public, the Bell Telephone monopoly. No gentleman would have assailed Mr. Garland before obtaining all the facts. Mr. Garland was not in Washington when permission for the suit was granted. If he had been, and had refused permission, I would have insisted that his private affairs should not prevent his performing a duty to the public."

A dispatch from Washington of Oct. 4 says: The statement that Attorney-General Garland is the owner of stock worth $1,500,000 face value in the Pan Electric Telephone companies has surprised a good many people, and yet the figures given do not represent his entire interest in the telephone business. The Pan Electric Telephone Company has licensed six or eight local companies, the capital stock of each of which averages about $5,000,000. Under the licenses granted, the Pan Electric Company receives 40 per cent. of the capital stock of each of the local companies. For example: The Baltimore Company, which was organized by ex-Congressman Henckle and Bradley T. Johnson, is stocked at $5,000,000, two-fifths of which belong to the Pan Electric Company; and Mr. Garland as the owner of one-tenth of the stock of the latter company is entitled, under the terms of the license, to stock of the Baltimore Company worth $200,000. It is intimated that his interest in the stock of the local companies amounts to about $1,500,000.

Mr. Garland's ownership of stock of the Baltimore Company, of course, makes him one of the defendants of the suit pending in the Baltimore court. It is understood that a meeting of the Pan Electric directors was held in Washington yesterday, and that Bradley T. Johnson, of the Baltimore Company, was designated to proceed to Memphis to represent the interests of the Pan Electric Company in the suit there pending, the hearing for which is set down for Oct. 12. It is supposed that General Johnson is to take the place of Casey Young, one of the special counsel employed by the Attorney-General's Department to prosecute the Memphis suit, General Young being incapacitated by illness from appearing in person.

The ramifications of the Pan Electric Company are extensive. One of the companies is called the Rogers Telegraph and Telephone Company. The president of it is General J. W. Denver, of Ohio; the secretary General Frank Armstrong, lately appointed an Indian Inspector; the treasurer, ex-Congressman Klotz, and among the other directors are ex-Congressman Money and Manning, of Mississippi, and Colonel R. F. Looney, of Memphis, the Tennessee member of the Democratic National Committee. The Rogers Company is advertised as: A combination of interests in the Pan Electric and the American Postal Telegraph companies. There is some reason to believe that one of the plans of the speculators interested in these various Pan Electric patents is the urging upon Congress of the establishment of a Postal Telegraph system, and it is asserted that the candidacy of ex-Congressman Money for the office of Postmaster-General was backed by all the interests involved.

Some persons appear to believe that the success of the pending suit in Memphis, and the breaking down of the Bell monopoly, is to result in making telephones free to everybody, and, therefore, that the plaintiffs in that suit are public benefactors who wish to engage in the telephone business as a purely philanthropic enterprise. Judging by the terms of the licenses granted by the Pan Electric and National Improved Companies to local organizations, such is not the case. For example, the license granted to the Pittsburgh Company requires the local company to pay a royalty of $2 a year for each transmitter and receiver, and to pay $5 for each of those instruments furnished, besides $6 for each telephone furnished.



THE FREEMAN DYNAMO.

There is no confirmation of the report that Attorney General Garland has decided to dispose of his interest in the telephone business. It is known that he has had several conferences with the President, two of which are supposed to have related to the subject of his connection with the telephone suits.

The Freeman Dynamo.

Our illustration represents a dynamo machine which has been designed with the object of attaining efficiency combined with cheapness. To this end nearly all parts have been so constructed that they can be quickly finished in the lathe so that cost of production is reduced to a minimum. As will be seen, each pole-piece carries eight coils, four on each side, making sixteen in all. These are wound so as to make the pole-pieces of opposite polarity, and their outer ends are bolted to the two circular discs which carry the bearings for the armature shaft. The armature itself is of the Siemens type, and wound so as to reduce the sparking at the commutator to a minimum. The machine, which is built by Mr. Warren P. Freeman, of this city, is part of an incandescent system in which a lamp of novel construction is used. The carbon is a straight thread, which is supported by a thin glass rod bent at the top. This allows the length of the carbons to be regulated so as to be of uniform resistance, and the distribution of light in the plane perpendicular to the lamp is equal in all directions. The cost of the lamp is also claimed to be considerably decreased by this method of construction.

Improvement in the Conductivity of Wires.

The high conductivity which our wire makers now guarantee for their products draws attention to the improvements which have taken place during the last thirty years. Thus in a late discussion upon electric conductors, Mr. Preece exhibited a table showing the progress in conductivity of submarine cables. Taking pure copper to represent 100, it showed that the Dover-Calais cable of 1851 was only 42; the Transatlantic of 1856, 50; the Red Sea of 1857, 75; Transatlantic of 1885, 96; the Irish Sea of 1882, 97.9. Much more improvement in this direction can hardly be hoped for; indeed the last figures show that excellent methods of manufacture have been developed and that foreign bodies and copper oxide have been practically eliminated altogether from the wire.

Some New Points in Patent Law.

Touching the power of the United States Attorney-General to institute proceedings to annul a patent, either because the patentee is not the first inventor or for any other reason, Mr. E. N. Dickerson says:

In my opinion, there is no such authority, and I give my reasons. In England a patent is granted by the Crown as an exercise of prerogative, and not as a right. In the grant the Crown reserves the right in express terms to revoke it at any time "if the grant is contrary to law, or prejudicial or inconvenient to her Majesty's subjects;" and, in accordance with the provision, the law officers of the Crown proceed at their discretion against any patent. In this country, however, the Constitution of the United States recognizes the absolute right of the first inventor to be "secured" in the enjoyment of his invention for a limited time, and Congress is required to make laws in accordance therewith.

The first act was in 1790, and it authorized the grant of a patent to any one upon the mere filing of a description of the invention, just as it was in England; and there was no tribunal established to examine such applications, and to reject those in which it appeared that the invention was not new with the applicant. The fifth section of that statute provided that "within one year after leasing the said patent, but not afterward" upon the "oath of affirmation" of any person before a United States Court that "any patent which shall be issued in pursuance of this act was obtained surreptitiously or by false suggestion, and motion made to the court," the court was empowered to repeal such patent. This power eminently included the Attorney-General, and expired in one year, after which there was no authority to proceed against the patent.

The act of '93 reënacted the fifth section of the act of '90, but extended the time to "three years," within which a proceeding to annul the patent must be taken. It also, in the sixth section, introduced another proceeding for annulling the patent, which was operative during its entire term. This proceeding took effect, however, only in case of a suit by the patentee against an infringer, who should set up and maintain as a defense that the patentee had fraudulently obtained his patent, or "that the thing patented was not originally discovered by the patentee," in which case it was provided that "the patent shall be declared void." From 1793 till 1836 the law was such that the Attorney-General or any person might move against a patent within three years after the grant, and have it annulled for any reason which would have been a good objection to granting it; and in addition thereto, if the patentee had committed a fraud, or was not in fact the first inventor, his patent might be declared void by the court in any suit in which he attempted to enforce it.

In 1836 the Patent Office was created as a tribunal to try the question primarily whether an applicant was the first inventor or not; and if that tribunal found in his favor he was entitled to a patent, and could enforce his right to it by a judicial proceeding against the Commissioner of Patents if he was refused. This act repealed the two provisions of the former law above referred to; and from that day to this no authority has ever been given by statute to any one to proceed against a patent for its annulment, except in the case where the Commissioner of Patents has granted two patents for the same invention to different persons, one of which may be annulled by the court at the suit of the opposing patentee. But infringers have constantly been importuning Congress for a law authorizing the Attorney-General, at their solicitation, to institute suits in the name of the United States against patentees to whom the United States had granted patents after a judicial investigation; the object being to array the Department of Justice on the side of the infringers, and to convert the Attorney-General's office into an instrument in their hands for reversing the decisions of the Patent Office. Congress has always refused to introduce chaos into the patent system by authorizing one department of the Government to attack another, in defense of infringers to whom the law has afforded every defense against a patent granted to any one who is not the first inventor. Horace Day made great efforts to obtain such a law, that he might have the United States attack Mr. Goodyear, who made the great invention which has rendered his name immortal; and the infringers of the Bell patent have been at work on Congress for a long time in the same direction, but without success. The Committee of the House, however, reported last year that there was no such power residing in the Attorney-General, unless a new act were passed authorizing it, and recommended such a bill, which of course died in the Senate.

The pressure of the infringers upon the Attorney-General's office, however, has been so great from time to time that, as Mr. Goode correctly states, there have been several suits for the purpose of annulling patents by the United States. The first one was brought in Massachusetts against Professor Hosford's very valuable superphosphate patent, and Judges Shepley and Knowles delivered an exhaustive opinion turning the Attorney-General out of court and deciding that there was no such jurisdiction, for any reason whatever. [Attorney-General vs. Rumford, 2 Ban. and A., p. 299.]

The infringers were not content with this, however, and other Attorneys-General repeated the experiment. The

next case which raised the question was the United States vs. Doughty, 7 Blatchford, 424, and the bill was turned out of court on demurrer because not properly presented. The jurisdictional point was not passed upon.

The next case was the United States against Gunning, 18 Federal Reporter, 511, by Wallace, J. The bill in that case alleged that the patentee had sworn "that he believed himself to be the inventor of the patented subject, and did not know or believe that it had been in public use or on sale in the United States for more than two years prior to his application, whereas both of these statements were false to his knowledge." Upon demurrer, Judge Wallace, contrary to the decision of Judges Shepley and Knowles in the former case, held that such a state of facts gave jurisdiction to the United States, but that such a bill could only be brought "between the sovereignty making the grant and the grantee." The United States proceeded with that suit, proved its allegations, and the defendant having offered no testimony to deny them, a decree was entered annuling the patent.

The next case is the United States vs. Frazer, 22 Federal Reporter, 106. That case presents precisely the state of facts in the pretended suit of the United States vs. Bell. The court says "that this bill was prepared here by a firm of well-known attorneys who make patent cases their specialty, and submitted to the Attorney-General, who transmitted it to the District Attorney here with directions to file it with a sufficient bond to indemnify the United States against all cost and expenses on account of this proceeding." Upon that state of facts the bill was dismissed by the Circuit Court in the Seventh Circuit as not maintainable; and the court remarked that 'the practice here inaugurated will, if followed, transfer nearly all litigation on patents, except mere questions of fact as to infringement, to the office of the Attorney-General, instead of leaving it in the hands of the persons directly interested. Patentees, as a rule, have trouble enough to establish their patents without being in peril at any time during the life of their patents of a suit, in the name of the United States, brought at the instance of interested parties, but not bound by any prior judgment or decree sustaining the patent."

The next and last case, United States vs. Colgate, decided last December by Judge Wallace, the same judge who maintained the jurisdiction upon the peculiar facts in Gunning's case, was this: The patentee, as Professor Bell has done, had brought suit in the courts, and his patent had been maintained; and, as in the present case, the infringers had induced the Attorney-General to bring his suit to try those questions over again in the name of the United States. Upon that state of facts Judge Wallace remarks: "At most, the allegations show that there was no novelty in the invention, and inferentially that he, knowing the prior state of the art, which was public knowledge, must have known there was no novelty. All the facts alleged to show want of novelty seem to have been considered in the case of Colgate against the Western Union Telegraph Company, where they were set up in the answer and where the patent was sustained. This branch of the bill, therefore, does not require much consideration," and he dismissed the bill on demurrer. The decision is not yet reported, but is on file, and of course is known to the Department of Justice, which instituted the suit.

The question whether there is any such right on the part of the Attorney-General has never been before the Supreme Court of the United States. The case of Mowry vs. Whitney, referred to by Mr. Goode as an authority, was a private suit by an infringer to repeal the patent under which he had been enjoined, exactly as if the statute of '93 was in force, and he had proceeded within three years of the date of the patent. On demurrer the Supreme Court of the United States dismissed the bill. In the decision of that question, however, the learned Judge writing the opinion made some dicta to the effect that the United States was the only party which could bring such a bill, and upon these dicta the Attorney-General founded his Rumford case when the question necessarily had to be decided. The Judges in that case reviewed the dicta of the Supreme Court in the Whitney case, and decided that there was no such jurisdiction. What the Supreme Court of the United States may say about it, it does not become me to prophesy, but as the law stands at present the courts have decided, in the First Circuit, that there is no such jurisdiction under any circumstances. In the Second Circuit, that where the patentee committed purjury, knowing that he was not the inventor, the Attorney-General may bring a suit, and the courts have jurisdiction; but that where the question whether he was the inventor or not has been tried in the courts, the bill of the United States must be dismissed. In the Seventh Circuit, that whatever the United States may do, it cannot lend its name to an infringer who carries on the suit at hi expense in the name of the United States.

An Ornamental Burglar Alarm.

Our illustration represents a burglar alarm recently completed for a well-known Western gentleman, whose æsthetic tastes led him to seek to cover up the true inwardness of this prosaic protective apparatus. The annunciators are inclosed within the case of ebony, and are hidden by two doors, held closed by an electric latch. As an alarm sounds, the latch is simultaneously released, and the doors spring open, exposing the drops. The bell is situated in the belfry above the case, and the usual plugs are provided for cutting out any part of the premises. The case, which is beautifully carved, of ebony and other costly woods, is over 5 feet high, and is 32 inches wide, being a fine bedroom ornament.

AN ORNAMENTAL BURGLAR ALARM.

A Notorious Telegraph School.

Notwithstanding the fact that the newspapers have exposed the business of the "Union Electric Telegraph Company," and the schemes which they practice to get money from unsuspecting persons, new victims are turning up, says the Cincinnati *Commercial Gazette* of Sept. 23, and the Police Commissioners, who have been fully advised of the matter, have failed to take any action toward its suppression. This firm, of which, so far as can be learned, a man named H. C. Roeth is the president, manager and sole proprietor, is known as the "Union Electric Telegraph Company," doing "business" in the Carlisle Building, at the corner of Fourth and Walnut streets. The same company have been in St. Louis, Chicago and San Francisco.

At Chicago the manager was arrested for obtaining money under false pretenses, and the questionable business was given an airing in the newspapers. The blanks of the company are printed after those of the Western Union, and read as follows:

"The Union Electric Telegraph Company. This company transmits and delivers messages only on conditions, limiting its liability, which have been assented to by the sender of the following message: Errors can be guarded against only by repeating a message back to the sending station for comparison, and the company will not be liable for errors or delays in transmission or delivery of unrepeated messages beyond the amount of tolls paid thereon, nor in any case when the claim is not presented in writing within thirty days after sending the message.

"This is an unrepeated message, and is delivered by request of the sender under the conditions named above.

"H. C. Roeth, President and General Manager, New York City.

"J. T. Whelham, General Superintendent, San Francisco, Cal.

"T. Gates Clark, Secretary, Chicago, Ill.

"A. Prescott, Superintendent, St. Louis, Mo."

Mr. H. C. Roeth, the President and General Manager, of New York City, can be found any day in a little room on the third floor of the Carlisle Building, Fourth and Walnut streets, Cincinnati. So far as can be learned, he is the entire company. Since he has been in Cincinnati he has used the advertising columns of the daily papers until they were closed against him, to accomplish his purpose. The advertisement states that men and women are wanted to learn telegraphing upon their lines, and a situation at from $75 to $150 per month promised as soon as they become proficient. The fact is that the company have no lines which run outside of their office, and no position to give.

The Western Union Company have absolutely refused to have anything to do with them. Young men and ladies have been misled by these advertisements, and have paid their money upon the promise of a position. One young man, named Josephs, was induced to give up his position in Toledo and come to this city. He paid $35 to be taught telegraphy, and was promised a lucrative position. He failed to get either, and sued for damages. The business was given an airing, and the magistrate awarded young Josephs $250 damages. A large number of persons have been wronged in the same manner. Among the latest victims are Lizzie and Kate Lorz, two sisters, living in Cumminsville. They claim that they paid $40 each to be taught telegraphy, and also for the promise of a position. They received neither.

H. C. Dillon, living at No. 9 Arch street, has been for several months in the employ of H. C. Roeth, and can vouch for all the facts here given, and many others, that go to show how this man has been wronging people who have, to the number of nearly a hundred, paid him $35 each in advance to be taught telegraphy and secure paying positions. The office has instruments and instructors, and the pupils are taught the alphabet and how to send and receive, after a fashion, but they get no situations through it.

Extensions by the Wisconsin Telephone Company.

During this season the Wisconsin Telephone Company has made extensions of upward of 250 miles of toll lines, built with hard drawn copper wire of No. 12 gauge. The principal lines built this season have been from Madison to Janesville, by way of Edgerton and Stoughton, 50 miles. This reaches the principal tobacco-raising district in Wisconsin. Another extension has been from Milwaukee to Manitowoc, by way of Sheboygan, 85 miles. This line reaches the principal dairy district of the State. Another principal extension is from Watertown to Waupun, by way of Juneau and Beaver Dam, with extensions to Horicon and Mayville. A second wire has also been built north from Milwaukee to Hartford, 40 miles; and an extension from Ripon to Montello. This brings the plant of toll lines now operated by the Wisconsin Company in the neighborhood of 3,000 miles.

It is found in this territory that the copper wire lines can be worked with excellent results between offices as far as 250 miles apart. An evidence of an improvement in general business in the Northwest is also found in the rapid developments of the Exchanges in Wisconsin, and particularly the Milwaukee Exchange. Four new multiple boards have recently been added at this office, giving facilities for 400 new terminals. Pending the completion of this new work there were ninety new orders for telephones in Milwaukee held waiting, and it is expected that upward of 200 new instruments will be connected between the 1st of September and the 1st of January, making a total of 1,600 subscribers. Large increases are also noted at Racine, Eau Claire, La Crosse, Oshkosh, Appleton, Madison and Janesville, and other large Exchanges in the State. It is also noted that the smaller Exchanges are without exception holding their own at this time, and no loss has been reported for upward of two months in the number of instruments at any town in the State.

Insurance Regulations for Electric Lighting.

The New England Insurance Exchange has adopted a new form of rules and regulations for guidance in the construction of electric lighting installations. The rules relating to the arc and incandescent system are an elaboration of those already in vogue; but we notice, in addition, regulations for incandescent lights on arc circuits, which we believe have not heretofore been insisted upon. The evident increase in the application of this system has made these new rules a necessity, and we therefore give them below.

INCANDESCENT LIGHT ON ARC CIRCUITS.

The running of incandescent lights or systems on arc circuits should be avoided; but wherever this is unavoidable, a proper device or "distributer," such as may be approved by this "Exchange," must be provided, to prevent the possibility of an excessive arc current being thrown on to any one portion of the incandescent system; such device or "distributer" *must* have the approval of this "Exchange" before it is put in operation. It must remain open to inspection at all times, and no change made in any part of the installation after it has been approved, without consent of this "Exchange."

Where incandescent lights are run on arc circuits, the following-named practices are *strictly prohibited:*

The placing of the "distributer" or governor on any circuit, the tension of which is over thirty lights in series.

Fastening or attaching electroliers, or lamps, to any gas fixture which may be in electrical connection with the earth.

The running of *concealed* wires to the electroliers, or lamps, *under any circumstances.* They must be entirely open to view.

The placing of any distributer-box or regulator, electrolier, bracket or lamp in such position that it may be connected in any way with any other wires, steam-fittings, gas-pipes, gas fixtures, etc., which may be electrically connected with the earth.

The placing of the distributer, electrolier, etc., in any damp location, or in close proximity to any metal or other conductor of electricity.

The use of paraffine-coated wire in any way.

The building or placing of anything around the distributer or regulator so as to cut off easy access to it, or obstruct the access of air to it.

RULES TO APPLY TO THE RUNNING OF INCANDESCENT CIRCUITS WORKED FROM ARC CIRCUITS.

Only such wire as has been approved by this "Exchange" shall be used in constructing lines and circuits.

Wires must be run in plain sight. In damp places they must have a water-proof covering.

The positive wire or wires must be kept at least three inches from the negative wire or wires in running from the distributer or regulator, to the fixtures and lamps, and return, except that "twin wire" may be used for a single lamp, provided it has a *special insulation*, such as may be approved by this "Exchange."

No wires should be run through partitions, floors or walls without being incased in a tube of hard or soft rubber, porcelain, or the like.

The "safety fuses" must be so proportioned that they will melt long before the wire is heated to an unsafe degree.

Dust must not be allowed in the distributer box or any of the electrical connections.

The contact points should be kept clean, and care should be taken to insure solid electrical connections at all the points of contact, and all parts must be kept free to move easily.

In case any defect should arise in the distributer or regulator, or the wiring thereto, it must be arranged so as to automatically and absolutely shunt off from the arc circuit at once.

In working distributers, the line or circuit current must be kept at its standard amount by tests made by ampère meter, from time to time. In no case must the amount exceed the standard.

LAMPS AND GLOBES.

The frames and other exposed parts of arc lamps must be properly insulated from the circuit. Each lamp must be provided with a proper hand-switch; and wherever it is possible that an excessive current may be thrown on to any one lamp, or series of lamps, automatic shunts or switches must be provided for each lamp, to prevent all possibility of the forming of a dangerous arc.

Some arrangement must be provided to prevent the carbons from falling out should the clamps fail to hold them.

Arc lamps must have globes closed at the bottom; and wherever they are placed in proximity to any combustible material, like draperies, goods in show-windows, flyings in fabric factories or in wood-working establishments, they must be provided with very high globes or spark-arresters, and the globes be surrounded by wire netting, to prevent the falling of a broken globe. Broken globes must be replaced at once.

DYNAMO MACHINES.

Dynamo machines must be located in dry places; not exposed to flyings of combustible material, and must be insulated upon wooden foundations. They must be kept thoroughly clean and dry.

They *must* be provided with an automatic "governor" capable of controlling any change in the current.

TESTING.

All circuits should be tested at least twice a day with some approved apparatus designed for that purpose, in order to discover any ground connection or "escape" that may exist. One test should be made in the morning, and another in ample time before using the lights, to remove any defect should it be found to exist. The same rule for testing should be observed in any separate or isolated plant as in central stations.

The signing of these rules and regulations by any elictric lighting company or persons controlling electric lights, shall be considered as a guarantee on their part that they will have the testing performed on their circuits or lines, as above required.

On the Sensitiveness to Light of Selenium and Sulphur Cells.

BY SHELFORD BIDWELL.

Selenium is an element which in its properties closely resembles sulphur, and attempts have from time to time been made, hitherto without success, to develop in sulphur that peculiar sensitiveness to light which is such a remarkable characteristic of selenium. It occurred to me that if this property of selenium were really due to the accidental existence of metallic selenides, then the admixture with sulphur of metallic sulphides might be expected to lead to similar effects. Several cells were therefore constructed in which selenium was replaced by sulphur containing a proportion of silver sulphide, the electrodes being formed of silver wire, and they all turned out to be more or less sensitive to light.* When one of these cells was connected in circuit with a battery and a galvanometer, and a piece of magnesium wire was burnt at a short distance from it, the galvanometer deflection was instantly increased, being in some cases more than doubled, and when the light was extinguished the deflection immediately fell to nearly its original value. If a telephone was substituted for the galvanometer, and the cell exposed to a rapidly interrupted beam of light, the telephone at once gave out a musical note which was nearly as loud as that produced when a good selenium cell was used.

The resistance in most of these cells was diminished by heating, and a number of experiments were therefore made for the purpose of ascertaining whether the effects described were due to the direct action of radiation or to the rise of temperature by which exposure to radiation is accompanied. It was conclusively proved that the direct action of radiation was in itself competent to produce the effects. Firstly, the diminution of resistance due to light was instantaneous, while that produced by heating the cell was gradual. Secondly, the interposition of a glass trough containing a saturated solution of alum made no great difference in the result. Thirdly, a rise of temperature sufficient to produce any sensible effect could not possibly have been caused by the amount of light which was able to diminish the resistance in a marked degree. This was proved by the following experiment: On a cloudy day the cell, with the alum trough before it, was placed at a distance of 16 feet from a small window, all the other windows in the room being darkened. With a battery of one Leclanché cell and a reflecting galvanometer, it was found that closing the window shutter caused an instantaneous swing of the spot of light through 90 scale divisions in the direction indicating increased resistance, and when the shutter was again opened there was immediately an equal swing in the opposite direction. A delicate thermopile, connected with a galvanometer of low resistance, was then put in the place of the sulphur cell. On opening the window shutter a deflection occurred, indicating a current, which was found by trial to be equal to that produced by the radiation of the human body at a distance of 10 feet 6 inches. Now a nearly red-hot brass rod, held at a distance of little more than an inch from the cell, produced a gradual fall of the resistance, which in 15 seconds was indicated by only 23 scale divisions, and it is needless to say that the heat communicated by the human body at 10 feet 6 inches was entirely without visible effect. Lastly, in the case of one cell (which contained sulphur and silver sulphide in equal parts) light and heat produced opposite effects. A paraffine lamp at a distance of 18 inches diminished the resistance. When the lamp was placed at a distance of 10 inches, the galvanometer needle first moved in the direction indicating a further fall of resistance; but after a few seconds, when the temperature began to rise, it turned in the opposite direction. On moving the lamp to a distance of 4 inches from the cell, there was at once a large deflection, indicating increased resistance, the temperature effect completely predominating over that of radiation.

When, as in the case of these cells, a current of electricity passes between silver electrodes through a mass of sulphide of silver, silver will be deposited upon the cathode and sulphur upon the anode. Now, sulphur has an enormously high resistance, and the existence of a mere film of free sulphur upon one of the electrodes would be sufficient to stop the current altogether. The current is not in fact stopped, because the deposited sulphur at once combines with the silver of the anode, merely adding a new layer to the electrolyte. Thus the metal of the anode gradually combines with the sulphur of the electrolyte, and the conductivity of the arrangement will depend to a great extent upon the facility with which this combination is effected, the quantity of electricity which can pass in a given time being limited by the quantity of sulphur which is capable of uniting with the electrode in the same time.

Sulphur combines with silver far more readily than with iron. If, therefore, my views are correct, we should expect a cell with an iron anode to offer a much greater resistance than one which had an anode of silver; the material of the cathode, so long as it was a good elementary conductor of electricity, being of comparatively little importance. To test this idea, a cell was made consisting of electrodes of iron and silver imbedded in a mixture of sulphide of silver and silver. The cell being connected with a battery and a galvanometer, it was found that its resistance was nearly thirty times as great when the current passed from iron to silver as when the direction of the current was from silver to iron.

It might therefore be expected that the resistance of a sulphur cell with silver electrodes would be diminished by any influence which assisted the combination of silver with sulphur. Experiment seems to show that such an influence is exerted by light.

A glass plate covered with silver leaf was placed, with the silvered side downward, over a crucible of boiling sulphur. One-half of the plate was covered with a piece of black cloth, and the arrangement was exposed to bright sunshine. In a short time the visible portion of the silver was darkened, owing to its partial conversion into sulphide; the cloth was then removed, and the silver beneath it was found to be scarcely discolored.

Since this effect might possibly have been due to other causes than the action of light (such as the unequal condensation of sulphur-vapor upon the covered and uncovered portions of the plate), the experiment was made in another form. A piece of silver-leaf attached to glass was brushed over with a solution of sulphur in bisulphide of carbon, and, in order to keep the temperature low and uniform, the silvered glass plate was immersed in a basin containing cold water, which was placed in the sunshine.

A board was laid across the top of the basin so as to shade one half of the plate, the other half being exposed to the direct rays of the sun. In a quarter of an hour the exposed portion of the silver had acquired a dark brown color, while that which had been protected was of a pale yellow tint, the outline of the shadow of the board being sharply defined. I think we have here the strongest evidence that the combination of sulphur with silver is assisted by light.

But it is not perhaps necessary to assume that the effective action of light is confined entirely to the electrode. It seems reasonable to suppose that any circumstances which are favorable to the union of two substances, when they have a tendency to unite, would also be favorable to their separation when from any cause they have a tendency to separate. If, then, as is commonly supposed, electrolysis involves a series of decompositions and recompositions, both these processes would be assisted by the same agency which under ordinary conditions favors the union of the constituents of the electrolyte. The electrolysis of silver sulphide may therefore be assisted by light, and its electrolytic resistance at the same time diminished.

All the sulphur cells hitherto mentioned were made with silver sulphide and silver electrodes. Silver was in the first instance chosen, as being especially suitable for the purpose on account of the facility with which it combines with sulphur. A few experiments have since been made with copper and copper-sulphide, but no indication of sensitiveness to light has yet been obtained with these materials, though I do not consider the results conclusive. But even if it should turn out to be the case that silver is the only metal which in conjunction with sulphur is capable of forming a combination sensitive to light, it would still, I think, remain probable that the action of light upon the resistance of selenium, in conjunction with any metal whatever with which it formed a sensitive combination, is of a similar nature to that which occurs in the case of sulphur and silver.

* Several different forms of these cells are fully described in a paper recently communicated to the Physical Society, and published in the *Phil. Mag.* for August, 1885.

A New System of Postal Delivery.

The new special delivery system adopted by the Post Office, and going into force immediately, is destined, if successful, to lead to many other modifications, and possibly to affect the operations of express and district messenger companies. Commencing on the 1st inst., persons wishing to have letters delivered at once in the city have been able to do so by affixing to the letter, in addition to the regular rate of postage, a special delivery stamp, which costs 10 cents. Such letters sent to cities and towns having free delivery service, or any city and town containing a population of 4,000 or over, are delivered by special messengers immediately on arrival at the office. These special deliveries are made between 7 A. M. and 12 midnight. In this city Postmaster Pearson has decided to begin the service with the use of substitute carriers, and a force of 160 men is now on duty. The number will be increased as occasion demands. The stamps may be purchased at the stamp windows in the General Post Office, at all the branch offices, and also at the various agencies throughout the city where stamps are sold.

The new stamp is oblong in form, 13-16 of an inch by 1 7-16 inches. On the left is an arched panel bearing the figure of a mail messenger boy on a run, and surmounted by the words, "United States." On the right is an oblong tablet ornamented with a wreath of oak and laurel, surrounding the words, "Secures immediate delivery at a special delivery office." Across the top of the tablet is the legend, "Special postal delivery," and at the bottom the words "Ten cents," separated by a small shield bearing the numeral X. When letters bearing this stamp, as well as the regular postage at the rate of 2 cents an ounce, are received at the Post Office, they are separated from other mail matter immediately, and after an entry of the address is made in a record book, the letter is promptly sent by the messenger to the address. The letter will be stamped with the hour of its arrival at the Post Office. The messenger will also carry a delivery book in which the entries of time and number of the letter are made. On the return of the messenger the time of delivery and the name of the person who has receipted for the letter will be entered in the record book, or, if the letter is not delivered, the reason of non-delivery will be recorded, as well as a note of the subsequent disposition of the letter. Record will also be made if the letter is a registered one. Special delivery letters addressed to stores, offices, and other places of business known to have been closed before the hour at which they could reach the premises addressed will be retained until the first special delivery of the succeeding day, as will also be the case of letters received too late to insure their delivery before midnight. Postal cards bearing special delivery stamps will be treated in all respects as letters. Whenever more than one special delivery letter can be delivered on the same trip by the same messenger they will be delivered, but superintendent will be expected to exercise sound judgment and discretion in the matter.

In this city the operations of the special delivery system at the New York office are placed under the charge of the General Superintendent of the Fourth Division. To secure the fullest possible benefit of the special delivery system, letters should be deposited at the General Post Office or at one of the branches, but those deposited in the street letter boxes will receive immediate attention as soon as they are brought to the Post Office or to a branch office. The letters may also be handed to carriers on duty, and will be taken to the office on their return. Postmaster Pearson also recommends urgently that all letters intended for special delivery shall bear the names and addresses of the senders. As the system is new, and the probable extent of its use cannot yet be determined, the Post Office authorities ask the indulgence of the public for any shortcomings that may be apparent in the beginning, but give assurance that every possible effort will be made by them to insure its success. The messengers will be paid according to the number of letters they take out—80 per cent. of the value of the special delivery stamps. They are allowed no car fares, and all local special deliverances addressed to points within the city far distant from the place of deposit will be first dispatched with other mail matter to the nearest point from which they can be specially delivered. Registered letters will be delivered as others in the special system, but must have both registry fee stamps, the special delivery stamps, and regular postage stamps attached.

A New Galvanic Cell.*

BY A. E. PROF. DOLBEAR.

I have discovered that if zinc be immersed in a saturated solution of ammonium chloride in a porous cup, and carbon in a saturated solution of bichromate of potash mixed with sulphuric acid, the electromotive force of the combination is about 1.1 volts, which is higher than that of any other primary battery with common and cheap materials that I am acquainted with. The internal resistance of such a cell will, of course, depend upon the size and disposition of the elements, but when made of the size of an ordinary Leclanché cell, the zinc being simply the rod employed with it and the carbon plate, 6 × 2 inches, its resistance is less than half an ohm. Its constancy is such that it may be kept on short circuit (4 or 5 ohms external resistance) for several days and not fall in strength to any considerable degree. Such a cell gave me at the outset a current of .34 of an ampère, and after four days of circuit through a total resistance of 6 ohms gave .26 of an ampère. And this fall was due to increase of internal resistance, which had risen about an ohm, while the E. M. F. had not fallen much.

If the bichromate solution be mixed with strong nitric acid instead of sulphuric acid, the E M. F. rises to 2.3 volts, which, I think, is unprecedented and remarkable. Its durability is not quite so great, however.

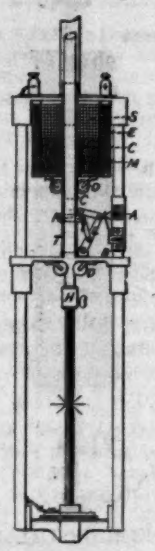
This cell has the further advantage of giving no fumes: so it is not offensive. It may be used on open circuit, no electric action or solution going on; but after two or three weeks the chromate solution diffuses itself so as to reduce its current strength. For electromotive force, low internal resistance, constancy and freedom from gaseous products, the cell is superior to any other cell I know of.

* Read at the Ann Arbor meeting of the American Association for the Advancement of Science.

A New English Arc Lamp.

Among the arc-lamps recently patented in England is that of H. F. Joel, the mechanism of which is shown in the accompanying cut. A main coil *M* and a shunt coil *S* act upon a hollow movable iron core *C*, which surrounds the upper carbon-holder. This core has a brass tube extension piece, and is guided by rollers, *D D*. The core is pivoted to one end of a double link *L*, the other end of which is pivoted to the case *B*. Attached to one arm of this link is an arm *l*, connected to a clamping ring *R*, slightly larger in diameter than the upper carbon-holder which it encircles.

When not in action the link *L* rests against an adjustable stop *A'* when the shunt coil *S* is partially short-circuited,



A NEW ARC LAMP.

and the current passes through a thick wire coil *E*, while the clamping ring *R* rests on an adjustable tube *T* and allows the carbon-holder free movement.

When a current passes through the lamp, the core *C* is drawn up into the coil *M*, the link *L* is straightened and the clamping ring *R* is tilted, which clamps and lifts the carbon-holder and so forms the arc.

When the arc increases in length the action of the shunt coil *S* causes the core, together with the carbon-holder, to descend until the clamping ring rests on the tube *T*, and frees the carbon. The relative motion of the core and carbon-holder may be varied by varying the lengths of the arms of the link or the angle between them; and the pivot of the lower link may be slotted to enable the whole arrangement to be lifted to form the arc. A spring may

PHILIPP REIS.

be attached to the clamping ring instead of the link *l*, or may be used to press upon the link.

Modifications are shown in which two systems of links pivoted crosswise are used, or two half-ring clamps are substituted for the clamping ring, and actuated by springs or by a weight.

Philipp Reis.

The universal interest manifested in the litigation regarding the telephone and the alleged inventors of the telephone prior to Bell, makes this occasion opportune for a brief recounting of honors recently paid to the memory of Philipp Reis. Without entering here into the judicial aspect of the question, we may say that there can be no doubt that the work of Reis deserves recognition, as it paved the way for the establishment of one of the greatest industries of the day. The honors paid to Reis, though tardy, are none the less deserved, and the occasion of the unveiling of a monument to him brought together a large number of representative men, among whom were some who had assisted him in his experiments. The bust of Reis which the people erected to his memory, is situated in his birthplace, Gelnhausen, near Frankfort-on-the-Main. It is the work of the sculptor Antoine Carl Rumpf, and faithfully portrays the original. Our illustration, for which we are indebted to *La Lumière Electrique*, shows the bust, which rests upon a pedestal of granite. The whole is placed above a spring which breaks forth from a mass of rocks. The unveiling took place with appropriate ceremonies in August last.

On Underground Conduits.

This subject, which just at present is a fruitful theme of discussion, is taken up by one of our correspondents, whose remarks we give below:

It may not be generally known, says our correspondent, that by far the greatest number of overhead wires in cities are those of telephone companies, who will never consent to their being placed in close proximity to telegraph, fire-alarm and other cables, in metallic underground conduits. The currents on their circuits are of too delicate a nature to be endangered by the presence of disturbing metallic substances. The first important step taken by the telephone companies against metal conduits has been in Brooklyn, where the local company has presented to the subway commission a plan for, and received its permission to construct, a conduit of wood creosoted to preserve it for a time, into which telephone and telegraph cables are to be drawn, as necessity may require.

The objections to this system obviously are, first, that in a short time the streets must be torn up again to renew the conduit; and, second, that no provision is made for electric light and other wires and cables.

The results of costly experiments in Chicago, New York, and elsewhere with iron conduits have clearly demonstrated their failure—and this, whether in the form of iron pipes or longitudinal boxes, with iron or woven wire shelves, and for the following reasons. Iron in either form is subject, of course, to expansion and contraction, which loosens or breaks joints, no matter how tightly made, and admits moisture, water, sewage and illuminating and sewer gases. Moisture, whether precipitated from the air by condensation or by soakage from the soil, oxidizes the iron in the pipes or boxes, and the rust falling on the wires or cables inclosed incrusts them with a substance of high conductivity, which, at any point where the slightest defect exists in the insulating covering, forms a circuit which destroys and burns out the conductors.

Sewage which may be either highly acid or alkaline, and sewer gas likewise, which permeates where the liquid cannot reach, destroys rapidly the best known forms of insulating materials for wires and cables.

Illuminating gas, aside from its chemical action on insulating materials, has become a new horror in the number of explosions that have occurred in Philadelphia and Chicago, endangering life and eyesight.

The best forms of iron pipe and boxes used as conduits have been found on examination to be filled with water and silt. After many practical tests, electricians have arrived at the one conclusion of their failure. The solution of the problem must be found in a drawing in and out system, and that not of iron or wood.

Trying the Daft Motor.

The Daft electric motor was attached to a train of four cars on the Ninth avenue elevated railroad on Oct. 1, and after Jay Gould and a number of gentlemen interested in the new motor and the elevated railroads had taken seats in the cars, the train moved out of the Fourteenth street station. This was shortly before 10 o'clock. The motor worked very satisfactorily till it was just above Thirtieth street, when it came to a sudden stop. Mr. Daft had been running the train from Fourteenth to Fifty-third street and back for several evenings, and one trip was made last night before the public trial trip. To prevent any possible spreading of the laminæ of the brushes in the receiving dynamo, Mr. Daft rigged up an appliance consisting of a little brass clamp, which was placed to hold them together. He used it last night for the first time. This little brass clamp caught in the commutator of the dynamo and caused the accident. The mechanism was very slightly injured, and to make the necessary repairs took but little time.

When the train was again put in motion the crowd below cheered. The glare of light caused by breaking of contact at places, owing to rust in the central rail, brought the residents along the line to their windows.

At Fifty-third street the motor was switched off on to the down track, and made a flying trip to Forty-second street, where the Wall street men got off and went home.

"The main thing," said Mr. Gould, "was to show that they have the power under control, and they seem to have it so here. All that is necessary is refinement of methods to produce success." Russell Sage also expressed himself as believing in the ultimate success of electricity as a motive power. They all promised to come again and ride over the road with Mr. Daft. Then the motor drew the train from Forty-second street to Fourteenth street in six minutes. The motor weighs nine tons. The train of four cars, including the party, weighed fifty tons. Grades were mounted with ease. Among those present at the trial, besides Messrs. Gould, Sage and Dillon, were Charles Robinson, Colonel Hain, manager of the elevated railroad; W. K. Perris, D. G. Eggleston, David Bingham, Charles McWilliam, B. W. Franklin, Henry G. Buel, R. W. Hawkesworth and H. M. Hawkesworth, of the Daft Com-

pany. On the night of Oct. 5 another and most successful trial was made with a number of prominent men on board the train. Everything worked satisfactorily, and all present predicted the early final success of the undertaking.

The Course in Electrical Engineering at Cornell University.

Prof. R. H. Thurston, the eminent Director of Sibley College, at Cornell, has favored us with a copy of the curriculum of the new course in electrical engineering, which we give below. The figures following each study signify the number of hours devoted to it each week, and give a good idea of what can be accomplished:

FRESHMAN YEAR.

FALL TERM.—French *or* German, 5; rhetoric, 2; geometry and conic sections, 5; freehand drawing, 3; military drill, 2; hygiene, six lectures.

WINTER TERM.—French *or* German, 5; rhetoric, 2; algebra, 5; freehand drawing and machine sketching, 3; instrumental drawing, 2.

SPRING TERM.—French *or* German, 5; trigonometry, 5; descriptive geometry, text and drawing, 4; rhetoric, 2; military drill, 2.

SOPHOMORE YEAR.

FALL TERM.—Analytical geometry, 5; descriptive geometry, 6; experimental mechanics and heat, 3; shopwork, 3; drill, 2.

WINTER TERM.—Calculus, 5; electricity and magnetism, 3; chemistry, lectures, 3; drawing, 3; shopwork, 3.

SPRING TERM.—Calculus, 5; acoustics and optics, 3; drawing, 3; chemistry, lectures, 3; shopwork, 3; drill, 2.

JUNIOR YEAR.

FALL TERM.—Mechanics of engineering, 5; materials of engineering and mechanical laboratory, 3; physical laboratory, 3; chemistry, laboratory, 3; shopwork, 3.

WINTER TERM.—Mechanics of engineering, 5; kinematics, 3; physical laboratory, 3; chemistry, laboratory, 3; drawing, 2; shopwork, 3.

SPRING TERM.—Mechanics of engineering, 5; physical laboratory, 3; chemical laboratory, 2; drawing, 2; machine design, 3; shopwork, 3.

SENIOR YEAR.

FALL TERM.—Physics, laboratory work (testing of instruments and determination of constants), 6; steam engine and other motors, 5; mechanical laboratory, 2; drawing, 3; machine design, 3.

WINTER TERM.—Physics, laboratory work (dynamo machines and electric motors, tests of efficiency), 5; steam engine and motors, 5; mechanical laboratory, 2; drawing, 3; military science, 2.

SPRING TERM.—Physics, laboratory work, photometry, efficiency, tests of electric lamps, tests of telegraph instruments, lines and cables, 5; thesis (laboratory work, reading, etc., in connection with preparation of thesis), 12.

This course of four year' study leads to the degree of Bachelor of Science.

Telephonic Relays.

To the Editor of The Electrical World:

SIR: I notice that one of your subscribers asked the question a week or two ago, if there was any practical system of *telephone* relaying, and that you answered you knew of none. If the poor man is still seeking information, I can say that there is a practical telephone relay, and it is in daily operation between Bremen and Bremen Haven, in Germany, a distance of about fifteen miles. The subscribers of both cities are furnished with a single wire, using the ground as a return, as we do in this country. Between the two cities just named, four wires are strung on poles, which form two metallic circuits. When a subscriber at Bremen desires to communicate with another in Bremen Haven, their wires are connected to one of the metallic circuits through an induction coil which forms the relay. This coil, or relay, has two circuits, made by winding two wires, of 150 ohms resistance each, together on a spool having a core formed of soft iron wires. When the Bremen man speaks, he induces a current in the metallic circuit through the Bremen relay, and this current is again induced in the other man's wire through the second relay at Bremen Haven. The object in using the metallic circuit, of course, is to avoid the troubles arising from induction, retardation, etc. In fact, this is why the relay is used—to permit a metallic circuit to be worked in combination with single wire or grounded circuits.

NEW YORK CITY. R. G. BROWN.

[While Mr. Brown's account of the method employed above is interesting, we must point out that it possesses nothing in the nature of a relay. The use of two induction coils or *transformers* of energy *adds* nothing to the original impulse, but merely *modifies* it. A true telephonic *relay* must, as in telegraphy, transmit a powerful impulse under the action of a very weak one. Hence, until we obtain information to the contrary, we repeat tha we know of no practical system of telephone relaying. As bearing on this point the article on Mr. Perrin's telephonic relay, page 119 of the WORLD, Sept. 19, 1885 will be found of great interest.—EDS. E. W.]

A New Electro-Calorimeter.

In the series of investigations which Prof. A. Roiti recently undertook with the secondary generator of Gaulard and Gibbs, the alternating current produced required an instrument other than the ordinary galvanometer for its measurement. He constructed for the purpose an electro-calorimeter in which the current passes through a helix composed of several metals, which when heated changes its form. The change which has taken place after a definite time is measured, and within certain

FIG. 1.—ELECTRO-CALORIMETER.

limits it may be considered proportional to the quantity of heat developed by the current in the unit resistance of the circuit during the unit of time. This also applies to alternating currents because the self induction of the helix is very small. Prof. Roiti employs two spirals, both wound from left to right. One of the spirals *A C*, Fig. 1, is silvered on the outside, so that it expands under the action of heat, whereas the other, *C B*, in which the silver is inside, contracts. They are soldered at the ends *C*, so as to form a single helix *A B*, which being fixed vertically at its two ends, turns a pointer *C D*, in one direction or the other, according as it is heated or cooled In order to observe very small deflections, a small mirror can be attached at the point of junc-

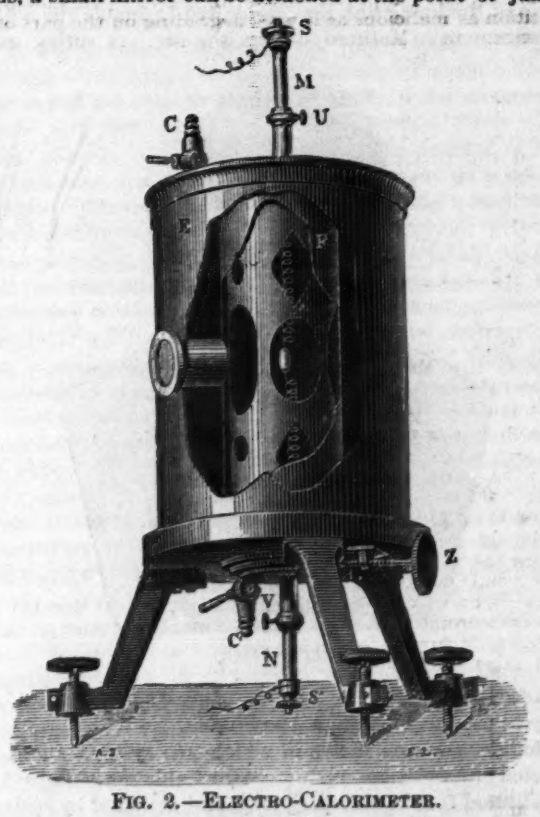


FIG. 2.—ELECTRO-CALORIMETER.

tion; the readings can then be taken with a telescope upon a scale at a distance. Two small copper rods *M H*, *K N*, lead the current to the helix, and are provided with binding screws, and in order to localize the heat better, two pieces of wire *H A*, *K B*, are interposed between the helix and the rods. The latter move in two guides, fixed in the centre of ebonite discs. Once adjusted, the rods are clamped by means of the screws *U V*. These two ebonite discs are screwed into the ends of a brass tube, Fig. 2, which has a number of openings, the large one being opposite the small mirror.

The object of this perforated tube is to keep the ends of the two spirals united so that the mirror can be placed in any position without straining the spirals. The calorimetric envelope has two walls *E F*, which contain enough water to protect the interior chamber and the two spirals from any violent change of temperature. Water can also be circulated by means of the cocks *C C'* if necessary. The tube with the mirror can be delicately adjusted by means of the tangent screw *Z*. In order to take observations the current is passed through the calorimeter by closing a key for a definite time, and this can very easily be done automatically, so as to give readings of perfectly constant duration. One person operates the key according to the beats of a clock, and another observes the initial position and the maximum deviation obtained.

In order to show the sensibility of this instrument, a current of $\frac{1}{100}$ of an ampère was passed through it for 14 seconds, and the deflection obtained was 1 mm. on a scale distant 100.

From experiments made with this instrument Professor Roiti is convinced that it can be used for studying the heat developed by the discharge of condensers or of a Ruhmkorff coil, etc. It is well to observe that in that case the discs of ebonite should be replaced by spiral plates of that material, so as to make the insulation greater. Where strong currents are to be measured, the instrument can be placed in a shunt circuit and its sensitiveness varied by means of resistance coils in the usual way. Experiments show that within certain limits the deviations recorded are proportional to the square of the intensities of the current causing them.

Professor Roiti is now at work upon another type of this instrument, which is designed for every-day practical work. In this the cylindrical helices are replaced by flat spirals, these being less sensitive to the action of the current.

Electric Lighting in the New York Aqueduct.

To the Editor of The Electrical World:

SIR: In reply to the communication of Mr. H. N. Curtis, New York agent of the Thomson-Houston Company, in your issue of 26th ult., I will state that the remarks made by me in reference to the Croton Aqueduct machines at the recent Electric Light Convention were based upon information received in reference to burnt armatures and the stopping of machines at intervals during the 23½ hours' run, to allow their armatures to cool off, and which I considered reliable. I am positive that the armatures of some of the bipolar inductor machines there were burnt, owing to the long run, as the burnt machine formerly at Shaft 19 has since been replaced by a Ball machine.

The first electric light plant placed on the Aqueduct was an old six-light Maxim, at Shaft 17, by Jones, Denton & Co., which has since been replaced by a ten-light United States. The next plant was a ten-light Ball by the same firm at Shaft 16. The same firm also shortly afterward procured a ten-light Thomson-Houston for Shaft 15.

The working of the Ball plant at shaft 16 was so satisfactory that the Ball Company was asked by the other contractors on the aqueduct to submit propositions for furnishing plants for the balance of the shafts, and the said company could, no doubt, have secured the work had a proper effort been made for it.

The Ball Company has not been anxious for much of the aqueduct work this fall, for the reason that since July more better-paying orders have been received than can be promptly filled with present manufacturing facilities of the said company.

As the aqueduct work will continue for about three years, and as the merits and comparative life of the different machines in the market must eventually be ascertained, we also deemed it advisable to give all the other electric light manufacturing companies a fair chance for the said work, and even invited them at the recent Electric Light Convention to try and place their machines there, for the reason that we are fully satisfied that the greater the number and variety of other machines employed there, the greater will be the final triumph of the Ball machine for economy and durability.

The Ball Company has recently been asked to exchange two 10-light Ball plants for two other 10-light plants employed on the aqueduct, but thus far have declined to do so for several good reasons.

The Thomson-Houston and other companies are therefore, to a great extent, indebted to the generosity and the present inability of the Ball Company to promptly fill orders for the number of plants they have on the aqueduct.

It must not be inferred that because the Thomson-Houston Company has the largest number of plants on the aqueduct, that the said company has the most economical and durable machine.

That the Ball dynamo is quite superior to any other machine in the market was fully demonstrated during the Philadelphia Electrical Exhibition last fall, when a nine-ampère Ball machine, rated for ten arc lights at the ordinary speed, was speeded up and operated seventeen lights of usual intensity during the Exhibition; and on the last night it operated twenty lights.

No other machine in this or any other country could safely stand such an ordeal, and I have no hesitation in challenging the world to produce the same electrical energy out of the same quantity of material used in the Ball dynamo.

The time is not far distant when long underground arc circuits, heavy traffic on electric railways, and other hard work will subject dynamos to a more severe ordeal than they are now undergoing, and I am convinced that the Ball dynamos will be fully prepared for all future emergencies and eventually be the machines with which all others will have to compete.

Arrangements are being made to properly equip a large factory, so as to promptly meet the growing demand for the Ball apparatus during the coming year.

H. W. SPANG.

READING, Pa., Oct, 3, 1885.

Determination of Death by Means of Electricity.

This idea, far from being new, is one of those that were early suggested in the minds of physicians in the application of the electric current for the cure of disease. It would naturally be supposed that the current might serve to indicate the presence of death by some specific difference in the nature or intensity of the muscular contractions. But experiment demonstrated that generally the muscular contraction, under the stimulus of electricity, was, for three or four hours after death, exactly the same as in life.

For this reason electricity was abandoned as a method of proving death. But the question has again been brought forward by some recent experiment of Dr. Buch. This observer has shown: 1, that the temperature is sensibly increased, during life, at the surface of the muscle exposed to the action of the electric current; 2, that this increase of temperature is *never* produced upon the dead body, even immediately after death, and while the muscular contractility is still perfect. This should afford an absolutely sure proof of death. Dr. Buch, in his experiments, makes use of an ordinary mercurial thermometer, simply applied to the surface of the skin. He waits until this thermometer shows the temperature of the surrounding medium, and then submits the subjacent muscle to the current of induction. The temperature of the skin increases several degrees under the influence of an energetic contraction. This phenomenon is constant during life, even in cases of complete paralysis of the part. On the other hand, in the dead body, whatever may be the force of the current and the violence of the contraction, the mercury remains stationary in the tube.

Edson's Specialties—Prices Reduced.

It is gratifying to be able to state to the users of steam, as well as Water Boards and others, that the Edson Recording and Alarm Gauge Co., No. 91 Liberty street, New York, in consideration of having completed their inventions and of the large and increased patronage contemplated, have *voluntarily reduced their prices 15 per cent.* New Pamphlets giving full details of Inventions, Expert and Patrons' Testimonials, specimens of the Records of Steam, Water and Electricity, sent on application.

NEW ENGLAND NOTES.

PROVIDENCE, R. I., Oct. 3, 1885.

The Rhode Island Electric Light Company reports business as being satisfactory, with a very encouraging outlook in a steady increase of its patrons for both arc and incandescent lighting.

This company has seventy-two of its 125 candle-power ("Mogul") lamps now in use in this city, and the Superintendent, Mr. Drake, made the following statement: "We have been running our Moguls up to 150 volts, at an average of 7½ hours a night during the past six weeks, and during that time only one of the lamps lost its efficiency."

The R. I. Braiding Company gives forth the statement that orders for its machines have been coming in more rapidly during the present month than at any other time heretofore. Many of the orders are from the West and Southwest. The company contemplates making a few changes and improvements about its premises, which will enlarge the facilities, both in manufacturing and shipping.

At the workshops of the Armington & Sims Engine Company everything indicates a rush of orders. Activity manifests itself in every department.

Filling orders for the "Little Giant" battery keeps the force of the Rhode Island Telephone and Electric Company very busy.

Mr. Coop, the president of the Narragansett Machine Company, expressed himself as being pleased with the increasing demand among electricians for the light and low-priced lathes manufactured by his company.

Mr. W. A. Harris is personally superintending the laying of the foundation for the mammoth engine now in course of construction for use in his own works.

The Brown & Sharpe Manufacturing Company have their latest catalogue off the press. It is really a credit to the concern and deserves perusal by all interested in the latest and skillfully fashioned machines and tools.

A few enterprising gentlemen are busy forming an electrical, scientific and social club in this city, which is already an assured success, there being some forty names enrolled up to this date It is hinted that the club will become a part of the Franklin Society of this city, and will afterward form a sub-society, separate from the other.

The Narragansett Electric Light Company has ordered another Armington & Sims 60 h.-p. engine, making the number (all of the same make) in use in the plant: Four 50 h.-p., two 60 h.-p., and one 90 h.-p. The present capacity of the plant is 470 arc lights, which is to be increased at an early day. The company having an eye to the welfare of the citizens of Providence, has now decided to add incandescent lighting to the plant, to be run off an arc circuit. Orders are already in hand for 360 incandescent lamps, with a larger number assured before the holidays.

WORCESTER, Oct. 5, 1885.

The Worcester Electric Light Company continues to give satisfaction with its system, and is rapidly increasing the number of its patrons.

The new Central Congregational Church has been fitted throughout by Messrs. Reed & Page, the rising and enterprising electricians of this city, with the "jump spark" lighting system and other electrical apparatus.

The Massachusetts Electric Time Company have their popular system for furnishing time in use in nearly all the banks, manufactories, hotels, business houses and society rooms in this city, and so far as can be ascertained it has given satisfaction wherever used, and has a reputation for regularity and reliability.

It is rumored about the city, that the leading business men have arrived at an understanding to the effect that should the Telephone Company insist on raising rates here, at least 100 telephones would be instantly ordered out.

THE TELEGRAPH.

Cheap Foreign Labor.—The Western Union Telegraph company is reported importing a number of low-salaried operators from the Canadian provinces for service in Eastern offices, and it is queried if this is a note of preparation for the rate competition with rival lines, announced as soon to take place.

Worthy of His Hire.—Judge Barrett has made an order directing Referee John Whalen, by whom the mortgaged property of the Bankers & Merchants' Telegraph Company was sold under foreclosure, to pay Receiver Farnsworth $5,000 on account of his commissions out of the proceeds of the sale.

Brief Speeches.—At the close of the International Telegraph Conference, Berlin, Dr. Stephan, the German Postmaster-General, said he would conclude his farewell address with a telegram of only two words to his guests: "Au revoir." But for once in his life he was outdone, for up jumped the Russian delegate, who begged to respond with a telegram only one-half as long: "Merci!"

The American in England.—"Won't you please rush that?" said an American, as he handed a dispatch to a telegraph operator in a little town near London. The operator looked up with a blank expression. "Won't you rush that dispatch, please?" repeated the gentleman. The look of amazement on the operator's face deepened. "Won't you send that just as quickly as you can?" the American explained. "Oh, yes," exclaimed the relieved operator; "just as soon as you get the stamp on."

An Invitation.—If New York really wants to clear its streets of telegraph poles and electric wires, let her send the Electrical Subway Commission or the "experts employed by the companies" to Chicago. Here they can see the first electrical subway ever constructed for practical work, and the wires to-day, after nine years' continuous service, as perfect as ever and still doing daily duty. They can find over 1,000 miles of underground wires—telegraph, telephone, fire alarm, electric light, etc. And if they don't come pretty soon, they will not be able to find a single line of wire above ground for any purpose within the city limits.—*Chicago News.*

The "Mosquito" Line.—The Baltimore & Ohio Telegraph Company, through the Arkansas Telegraph Company, opened an office at Little Rock, Ark., on Oct. 1, and for the first time in its history this city is to enjoy competitive telegraphy President Douglas, of the Arkansas Company, in his message to-day to D. H. Bates, President of the Baltimore & Ohio Telegraph Company, announcing the completion of the line, says: "In spite of opposition as malicious as it was degrading on the part of the enemy, the 'Mosquito Line' is open, and offers its tiny hands in token of eternal friendship."

Underground in France.—The *Petit Marseillais* says that the underground telegraph line from Paris to Lyons and Marseilles is completed, and the wires will be used as soon as the instruments destined for them are placed in the offices at Paris, Lyons and Marseilles. This underground line, added to those overhead, will not only allow messages to be accelerated, but will enable communications to be kept up, no matter what the state of the weather may be. Underground lines will also be laid between Marseilles, Toulon and Nice. Marseilles and Havre are already connected by a direct wire, and this not only secures rapid communication between the two ports, but places Marseilles in direct connection with the United States, as the Marseilles-Havre wire is to all intents and purposes the prolongation of the Franco-American cable, which abuts at Havre.

The Ticker in Chicago.—The Gold and Stock Telegraph Company, which runs the "ticker" interests of the Western Union Company, notified its Chicago subscribers, on Oct. 3, that "ticker" quotations would hereafter be furnished at the rate of $2 a week. This is a reduction of $4 a week, and brings a "ticker" within the reach of the humblest business man. The cut is made in order to freeze out the Commercial Quotations Company, which is the child of the Mackay-Bennett concern, and begins business next Monday. The Commercial Company issued circulars announcing that it would furnish quotations at $10 a month. When the Western Union Company announced its cut the representative here of the Commercial Company notified his superiors in New York, and was directed to offer to furnish ticker service at $5 a month The Chicago Commercial and Financial News Company, which is controlled by Robert Bruce and County Commissioner Van Pelt, has been in operation about a week, and is putting in instruments and furnishing quotations at $5 a week. Chicago business men are embarrassed at the opportunities offered by the three concerns, the news furnished by which is substantially the same.

The Cable Pool.—A dispatch of Oct. 3 from London says: The London managers of the Atlantic cable companies in the present pool will meet in this city next week It is stated that the object of the meeting is to arrange for a reduction of the present cable tariffs between England and the United States from 24 cents to 12 cents on ordinary or commercial messages, and from 12 cents to 6 cents on press messages. The directors of the different English companies in the pool are said to be in favor of making the proposed reduction. They take the ground that the opposition of the Mackay-Bennett cables must be ended by annihilation. This opposition, it is argued, has already made the pool dividends so small that the shareholders will consent to sacrifice them entirely for a time in a war of rates that will either break down the opposition or compel it to join the pool, and result eventually in raising the tariffs all around, and in an eventual increase of the pool dividends. The American pool directors, on the other hand, are said to be less willing to consent to the proposed reductions, and to be quite timid about entering into a war of rates. They profess to be uncertain about the outcome of such a war, and up to date have not been induced to consent to it.

THE TELEPHONE.

Mr. Gladstone in Norway.—While at Bergen Mr. Gladstone is said to have been particularly struck by the fact that in a town with a population not exceeding 50,000, there are not fewer than 500 subscribers to the telephone, and that between three and four thousand townspeople have already subscribed to a project for substituting electric lighting for gas in private houses and in the streets.

Not Too Rosy.—The New England Telephone Company makes the poorest report for July seen this year. Expenses are $7,400 more than in June, and the balance of the construction is only $5,611.61, against $14,000 and above for all previous months since January.

Gross receipts for July	$79,670.67
Gross expenses "	63,029.32
Net earnings "	16,641.35
Construction "	11,029.74
Balance	$5,611.61
Gross receipts, Jan. 1 to July 31	542,629.00
Gross expenses, " "	337,387.00
Net earnings, " "	155,242.00
Construction, " "	57,382.00
Balance	$97,800.00

Drawbaugh Litigation.—It was rumored last week that the People's Telephone Company, representing the Drawbaugh claim, was about to apply to Judge Wallace for a rehearing of the Drawbaugh case, had in the United States Circuit Court last October. It is ascertained that, while such a course has not yet been decided upon by the counsel of the company, it is now under consideration. The Drawbaugh defense of priority has been set up by the Overland Telephone Company in the suits brought by the Bell Company against it. There is newly-discovered evidence of great value in the Drawbaugh case that was not available, because not known, so it is claimed, at the time the suit was heard in the New York courts. "I am not at liberty to say what this evidence is," said one of the counsel in the Drawbaugh case last week. The question in the case is one of expediency, whether to go immediately to the Supreme Court or to push the Bell Company in a new trial before Judge Wallace with the later evidence."

THE ELECTRIC LIGHT.

Electric Light in Portland, Me.—The Municipal System of electric lighting, described in our issue of Sept. 12, will be started in Portland next week, and the entire city will be illuminated by the 15th of this month.

A Farewell Dinner.—On the occasion of the departure of Mr. H. E. Irvine from Montreal, where he has been located for some time in connection with the Royal Electric Company, an impromptu dinner was given him by the staff of the company, Saturday evening, Sept. 26. The affair was very pleasant and successful.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., a 26; Am. Cable, b 63½, a 64½; B. & M., b 1, a 1½; Western Union, b 70¾, a 70¾.

Telephone.—Am. Bell, b 178, a 179, Erie, b 25½, a 25½; New England, b 27; Mexican, b 1 1/16, a 1½.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales 16 Maiden Lane, New York.

THE Grimshaw patents are controlled by the New York Insulated Wire Company, whose wires and cables for aërial, underground and submarine use are constructed according to those patents. The company also makes the well-known Grimshaw tape and builds the Dowse Underground Conduit System. Its New York office is at No. 64 Broadway, that in Boston at 33 Oliver street.

Glenn's Sulphur Soap
Heals and beautifies, removes pimples and blemishes; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.

MISCELLANEOUS NOTES.

An Underground Franchise.—President Shelbourne, of the New York Electric Lines Company, claims to hold a franchise from the Common Council authorizing his company to construct an underground system of electric lines, to be rented to any and all users of electric conductors, on the conditions that the company pay into the city treasury 2 per cent. of its income, and that it accommodate all customers without discrimination.

The Cowles Patent for Insulating Wire.—With regard to the announcement made in our last issue by the Ansonia Brass and Copper Company and Messrs. Holmes, Booth & Haydens, notifying the public that they were prepared to enforce their rights under the above patent, the Bridgeport Brass Company, Benedict & Burnham Manufacturing Company and the Electrical Supply Company make a counter notice in our advertising columns to-day.

Demand for Electricians.—The attention of young men ought to be called to the fact that at present electricians find great difficulty in obtaining workmen to put their ideas into practical shape. If we suppose a hundred men graduated from college and admitted to the bar, and a hundred others thoroughly skilled in the electrician's art, it would be fair to predict that of the first class 90 would within a year starve to death if they depended on their business to support them, while every man of the second class would at once step into a living competency, and thereafter be practically independent of all worry about bread-winning. We do not hear that the "learned professions" are languishing for lack of recruits, but skilled laborers are wanted in many branches of enterprising in-

dustry. The young gentlemen who are not quite decided whether they will give their talents to the Supreme Bench or to some rich city church, will do well to think on these things.—*Providence Journal.*

Boston's New Time Ball.—The new time ball on the sub-treasury building is now in working order. Since a year ago there has been no time ball in Boston properly dropped, and for the past six months there has been none at all, as objection was made to dropping it by hand, which might cause variations of from one to five seconds. Sailors setting their chronometers by it, in a long voyage, would have so great an error that serious consequences might arise. The new ball is operated by the Harvard Observatory clock. The apparatus is the design of the Naval Observatory, at Washington, and is a new one. The new ball is made of steel hoops, is covered with canvas, and is three feet in diameter. It is placed on a hollow pole, through which the hoisting ropes run. The ball falls into an iron tank padded around the upper edge, just large enough to let the ball fall into it. This serves as an air cushion and prevents jar to the building. In the bottom of the tank are small air-holes to allow the air gradually to pass out.

The Judkins Train Signal.—An electric train signal, a substitute for the bell cord, has been in daily use on a train on the Providence road since last May, says the Boston *Herald*, and its operation has been so satisfactory that other trains on the same road have been equipped with it. All the trains on the Concord & Portsmouth Railroad have more recently been equipped with the same signal, and the Boston & Lowell system is having its through trains in Montreal fitted up with the appliance. The same company—the Judkins Railway Train Signal Company—has just contracted to equip all the passenger trains of the Boston & Maine road, including both divisions, and the equipment of the Maine Central trains is also assured. General Manager Furber, of the Boston & Maine, is well known as one of the most conservative of men, and his indorsement of the signal is evidence of its excellence. The signal is becoming known outside of New England, and the New York, Lake Erie & Western road has already had one train equipped, and its operation pleases Superintendent Thomas so well that he proposes to have the signal placed on other trains. The work of equipping the trains of the Milwaukee & Northern Railroad is in progress, and assurances are made that the entire system of the Chicago, Milwaukee & St. Paul will ere long put on the same signal.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED SEPTEMBER 29, 1885.

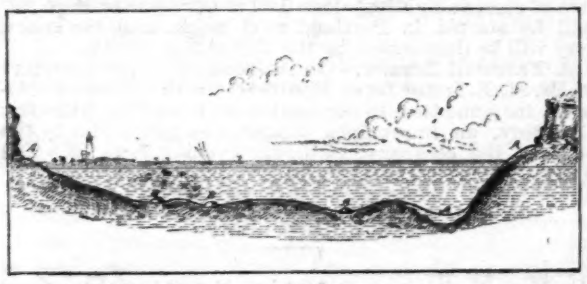
Electric Steam Governor and Electric Water-Wheel Governor; Edward H. Amet, Chicago, Assignor to Herbert A. Streeter, same place, (1) 326,933, (2) 326,934

(1) Consists in combining with the valve or device which controls the speed and power of the motor a centrifugal governor and a secondary-governor mechanism controlled by an electromotive device actuated by the current produced, which secondary-governor mechanism has a yielding or spring connection with the valve-stem, so that the centrifugal governor may, in case of accidents, control the valve and maintain the normal speed of the engine.

(2) An electro-magnet is arranged in the external circuit, and the movable armature of this electro-magnet operates to reciprocate a shaft in one direction when the current increases, and the opposite direction when the current diminishes. The shaft is connected by appropriate gearing or mechanism with the gate-shaft of the water-wheel, which operates to open or close the gate.

Electrical Attachment for Dental Chairs; Charles A. Eisenhart, York, Pa..... 326,957

Consists in electrodes of shape and character for ready application to the arms of a dental chair, to be grasped



327,460. ANCHOR FOR SUBMARINE CABLES.

by a patient while undergoing a dental operation. It is set forth in the specification that when the patient is given electric shocks he will be relieved of the pain of the operator in any dental operation.

Lantern for Electric Lamps; Saloman Heiman, London, England, Assignor to Frank S. Pommer, New York, N. Y..... 326,979

Consists of an external case composed of plano-convex or other suitable lenses connected together by a copper or other suitable metallic framing to make the same perfectly tight, and an inner glass case, in which latter the electric light, either "incandescent" or "arc," is arranged. The space between the inner and outer casing is filled with a suitable fluid.

Printing Telegraph Receiver; Charles M. Jordan, Minneapolis, Minn..... 326,989

The type-wheel is revolved, and the printing, feeding, pad-shifting and unison stop mechanisms are operated by one magnet, acting upon two polarized armatures parallel to each other, but reversed as to their poles, either being acted upon by a reversal of the current at the will of the transmitter.

Safety Device for Electrical Circuits; Elihu Thomson, Lynn, Mass., Assignor to the Thomson-Houston Electric Company, Connecticut.... 327,039

He claims a main or current supplying electric circuit and a local or supplied circuit deriving electrical energy therefrom, but intended to be electrically insulated or disconnected from said main circuit, and normally having a current of lower potential than said main circuit, combined with a safety cut-off operated by increase in potential of the current in the local or supplied circuit, whereby the latter is automatically disconnected from the main circuit upon the establishment of electrical connection between said main and supplied circuits.

Telephone Toll System; Henry Edmunds, London, England, and Charles T. Howard, Providence, R. I 327,073

They provide the subscribers' stations with an apparatus whereby the telephone cannot be used for the purpose of communication until a coin, of the denomination determined upon for each use of the instrument, has been actually deposited in a receptacle provided for the purpose, and whereby, also, in case the connection desired cannot be effected—as, for instance, by the line being in use—the coin deposited by the user is immediately returned.

It consists of the combination of the box or case having an inlet for a special coin or token, an inclined track, a switch or circuit-changer for connecting the telephone instruments to line, a removable stop to arrest the coin in the position to operate said switch, whereby the stations can communicate with the central office so long as the coin or token is held by said stop, an electro-magnet in the main line, its armature and connections for withdrawing said stop and dropping the coin, a trap upon which said coin comes to rest, and a releasing device under the control of the subscriber, whereby he may depress said trap to recover said coin or token.

Junction between Cabled and Uncabled Conductors; Ezra T. Gilliland, Boston, Mass..... 327,080

He provides an insulator composed of any suitable material, having one or more metal bars or posts extending completely through it and projecting a short distance upon each end. A cross-arm has perforations to receive these insulators. A longitudinal groove in the arm connects the inner ends of these perforations together, and into this longitudinal groove the inner ends of the metal bars in the insulators project. At the centre of the arm is an insulator having one or more holes communicating with this longitudinal groove on the inner end and with a water-tight cable-box upon the outer end. Each of the metal bolts in the insulators is connected by insulated conductors carried along in the longitudinal groove to screw-cups in the cable-box. The end of a divided line-

627,492. ELECTRIC CABLE.

wire is connected to the metal bolt in an insulator, and a cable containing a series of conductors is connected to the screw-cups of the cable-box, thus continuing the circuits of the pole-line through the conductors of the cable.

Submarine Duplex Telegraph; Alexander Muirhead, Norwood, Eng..... 327,097

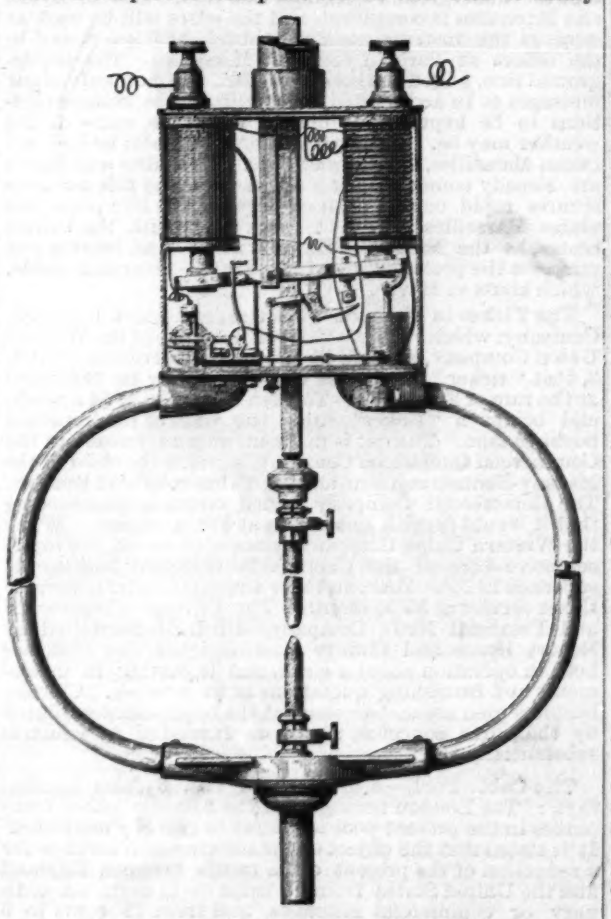
Consists of improvements upon his former patent, No. 234,490, granted the 16th day of November, 1880. More particularly, it consists of an adjustable condenser in the circuit, an electrical circuit surrounding said condenser for modifying the capacity of the same, an artificia lresistance in said modifying-circuit, and a supplementary condenser also in said modifying-circuit.

Electric Head-Light; Elisha B. Cutten, Pittsburg, Pa., Assignor to the Electrical and Mechanical Developing Co., of same place..... 327,143

There is provided an alarm which operates by the fall of the carbon when the latter is nearly consumed.

Carbon-Holder; Henry H. Levett, Philadelphia, Pa..... 327,282

Consists of a carbon-holder provided with an eccentric, which is adapted to clamp the carbon and hold it firmly



327,375. ARC LAMP.

in the block or V-shaped guide: of a spring adapted to support the eccentric, permit the eccentric to yield during its rotations on the carbon, and occasion a firm contact of the parts; and of a packing of non-conducting material interposed between the spring and the plate, which forms the bearings for the axis of the eccentric.

Secondary Battery; Eli T. Starr and E. Eugene Starr, Philadelphia, Pa., Assignors by direct and mesne assignments to the Starr Electric Storage Company, Camden, N. J..... 327,341

Consists of active matter, and a binding agent therefor, mixed to a pasty or plastic condition with a conducting-liquid.

Electric Arc Lamp; John G. Allen, Worcester, Mass.; Sylvia A. W. Gould, Administratrix of said John G. Allen, deceased..... 327,375

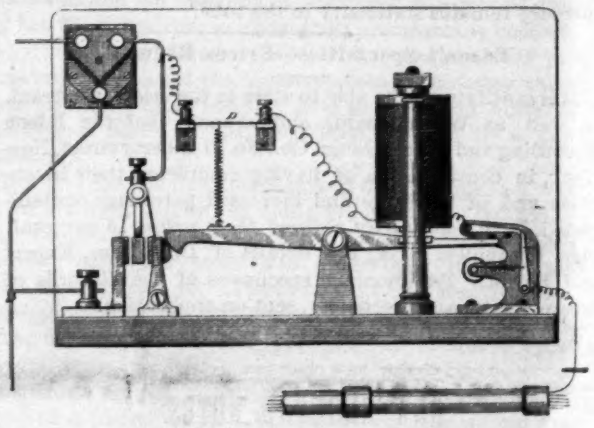
The invention consists principally of the clutch shown clearly in the cut.

Electric Railway; Henry T. Clay, Philadelphia, Pa., Assignor of one-third to Samuel G. Diehl, of same place..... 327,381

Consists of an improved rigid metallic conductor leading the electric current from the dynamo to the motor in the car; in a switch forming part of said rigid metallic conductor, and in the contact spring-brush travelling in said rigid metallic conductor.

Electric Railway; Robert L. Cohen, Philadelphia, Pa., Assignor of one-half to Samuel G. Diehl, of same place..... 327,382

Consists of a rigid metallic conductor leading the current from the dynamo to a brush moving freely therein, provided with a rounded internal upper surface and flanged sides.



327,500. SAFETY DEVICE FOR CIRCUITS.

Underground Conduit for Electric Conductors; George S. Cox, Philadelphia, Pa..... 327,383

Consists of a pipe having lateral chambers or stations extending preferably longitudinally with the pipe, and which have caps or covers provided with one or more flanges or short pipe-sections depending into the stations, and through which pass the tapping or other wires desired to be led into or out of the stations.

Electric Meter; John J. Green, Boonton, N. J., Assignor of one-half to H. C. Willis, T. F. Hunter, Brooklyn, N. Y..... 327,391

The device embodying the invention is a U tube, so provided with details of construction that an adjacent scale indicates the extent of electrical energy consumed by the translating devices in circuit.

Auxiliary Mouthpiece for Telephones; Charles A. Harrison, Bridgeport, Conn..... 327,393

The mouthpiece is provided with a spring clamp to hook upon a flange near the diaphragm.

Underground Conductor; Peter McMackin, Lonsdale, R. I..... 327,458

Consists of longitudinal sections fitted together, and the upper sections provided with apertures, combined with electrical conductor-supports placed at intervals for receiving and holding said conductors in position, and a filling of insulating material.

Electric Circuits, Conductors, Safety Devices for, and Machines for Winding Magnets; The above are titles in general of thirty-nine patents, included between 327,459 and 327,500, granted to Henry C. Spalding, Boston, Mass.

1. Most of the patents are for electrical conductors, which differ from one another in detail of winding and preparing with insulating and anti-induction films, tape or thread, and compounding in novel manner several wires and windings into one or more cables. The generic form is seen in the figure taken from patent 327,492.

2. Other patents embrace primary and secondary patents for underground and overground conduits for wires, and combinations of both.

3. Patent 327,460 is illustrated in the figure, and relates to an anchor for telegraph cables.

4. There are three or four patents for safety devices for electric circuits, patent 327,500 being shown in the cut. *D* shows the fusible metal.

5. One of the patents, 327,471, is for a machine for cutting paper for conductors.

6. Numbers 327,474 and 327,478 are for apparatus for laying underground conductors, and describe a vehicle provided with windlasses and operating mechanism.

7. One, 327,469, is for an electro-magnet in which the wire is wound with any viscous material covered with an insulating film such as paper.

Copies of any of the Patents mentioned in this Record can be obtained, with full specifications and drawings, from this office on application; price twenty-five cents each.